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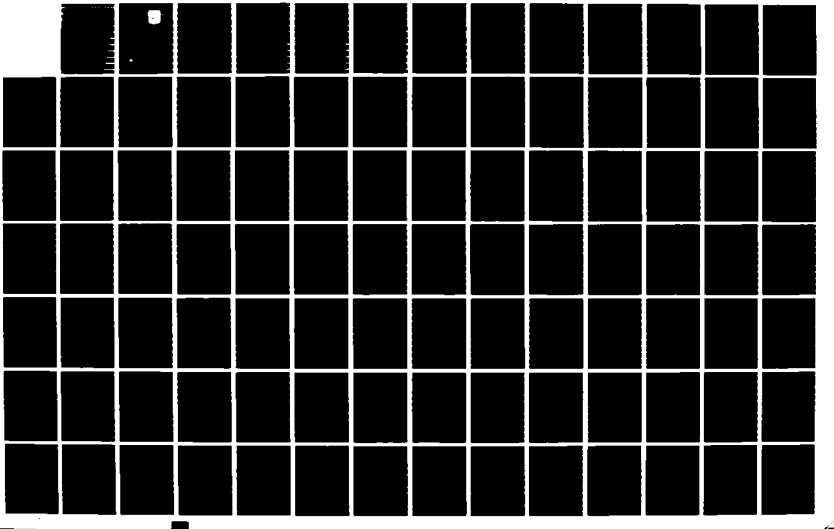

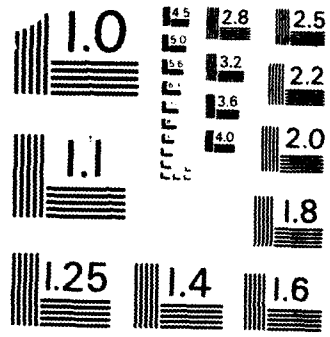

STUDY PROJECT

CORPS AREA COMMUNICATIONS SUPPORT
OF FM 100-5 (OPERATIONS) DOCTRINE

BY

COLONEL BRUCE A. JENSEN

31 MARCH 1986

US ARMY WAR COLLEGE, CARLISLE BARRACKS, PA 17013

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What are the tactical communications requirements demanded by operational art (AirLand Battle) doctrine in fluid large-scale maneuver exercises? In the first part of this research paper a determination is made as to the antecedents for us falling behind in C^3I employment doctrine, operational concepts, and Army Force Development so that, today, our earliest estimate for recovery will be with the fielding of the Mobile Subscriber Grid System (MSGS) capability with the fifth and last corps (I Corps in Fiscal Year 1992. Chapter Two

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explores those Concept-Based Requirement System (CBRS) procedures mandated by Headquarters, TRADOC, which if circumvented do not lead to an orderly and evolutionary flow of materiel from the Research, Development, and Acquisition (RDA) process. Many problems of interoperability, total systems integration, lack of inter-Service cooperation, and fixation on a limited number of feasible technological solutions to an operational concept (i.e., TRADOC Pamphlet 525-series), can be traced to a breakdown in the CBRS at the TRADOC Center/School level. The last chapter approaches the problem from a materiel development point of view, highlighting those management tools, e.g. Preplanned Product Improvement (P^3I), Logistics Support Analysis data, Continuous Comprehensive Evaluation (C^2E) during life-cycle testing, etc., which can be applied during the development of a C^3I or major weapon system program to determine early on if the operational effectiveness and operational suitability characteristics as outlined in the requirement document AR 71-9) are going to be met at the time of operational testing (OT). Finally, we will look into what other junior and senior military men and civilians are writing in professional journals about computer-based decision support system (DSS) technology, the ascendancy of embedded training (ET) techniques to support MANPRINT (Manpower and Personnel Integration) objectives, and the absolute need for high fidelity Joint Readiness Exercises (JRX) to stimulate the "demand-pull" rather than the "technology-push" of operational concepts at the Corps and Echelons Above Corps (EAC) levels.

USAWC MILITARY STUDIES PROGRAM PAPER

CORPS AREA COMMUNICATIONS SUPPORT OF FM 100-5 (OPERATIONS) DOCTRINE

AN INDIVIDUAL STUDY

by

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ABSTRACT

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What are the tactical communications requirements demanded by operational art (AirLand Battle) doctrine in fluid large-scale maneuver exercises? In the first part of this research paper a determination is made as to the antecedents for us falling behind in C^3I employment doctrine, operational concepts, and Army Force Development so that, today, our earliest estimate for recovery will be with the fielding of the Mobile Subscriber Grid System (MSGS) capability with the fifth and last corps (I Corps) in Fiscal Year 1992. Chapter Two explores those Concept-Based Requirement System (CBRS) procedures mandated by Headquarters, TRADOC, which if circumvented do not lead to an orderly and evolutionary flow of materiel from the Research, Development, and Acquisition (RDA) process. Many problems of interoperability, total systems integration, lack of inter-Service cooperation, and fixation on limited number of feasible technological solutions to an operational concept (i.e., TRADOC Pamphlet 525-series) can be traced to a breakdown in the CBRS at the TRADOC Center/School level. The last chapter approaches the problem from a materiel development point of view, highlighting those management tools e.g., Preplanned Product Improvement (P^3I), Logistics Support Analysis data, Continuous Comprehensive Evaluation (C^2E) during life-cycle testing, etc., which can be applied during the development of a C^3I or major weapons system program to determine early on if the operational effectiveness and operational suitability characteristics as outlined in the requirement document (AR 71-9) are going to be met at the time of operational testing (OT). Finally, we will look into what other junior and senior military men and civilians are writing in professional journals about computer-based decision support system (DSS) technology, the ascendancy of embedded training (ET) techniques to support MANPRINT (Manpower and Personnel Integration) objectives, and the absolute need for high fidelity Joint Readiness Exercises (JRX) to stimulate the "demand-pull" rather than the "technology-push" of operational concepts at the Corps and Echelons Above Corps (EAC) levels.

TABLE OF CONTENTS

second generation), there is bound to be interface (interoperability) problems between the older (analog) generation equipment items and the newer digital communications systems.

When I first met "Sparky" we were Radio-Teletype Operator (MOS: 053) specialists together in the late 1950's and assigned to Cambrai Fritsche Kascerne, Darmstadt Germany, as members of the 32d Signal Battalion, Corps Command Operations, V Corps. His deployment overseas had been delayed because of the mobilization for the Lebanon Crisis in the Middle East in the Fall of 1958. "Sparky" was smarter than the rest of us tactical communicators. Rather than thinking that single-channel High Frequency (HF) radio and Radio-Teletypewriter (RATT) were the sole answer to a Corps Commander's Command and Control (C^2) problem, he curtailed his conscripted status, reenlisted, changed his serial number from "US" to Regular Army (RA), and he attended the US Army Southeastern Signal School course on the multichannel (radio/cable) communications links which were carrying the bulk of V Corps telephone and land-line (vice RATT) teletype traffic. The equipment he learned to operate and repair was the Frequency Division Multiplex (FDM) equipment with its telltale "bed spring" antenna system which had to be hoisted vertically into position with a three-man crew and could only support the weight of the antenna and 40 feet of mast section elements.

"Sparky" and I reminisced about the "ole" FDM equipment, and I told him of seeing a United States Army Reserve (USAR) Signal Battalion using such a system within the past few months. It was set up in front of XVIII Airborne Corps, Headquarters. Fort Bragg, North Carolina. He showed disbelief that more than 25 years and the onset of the TRI-TAC

INTRODUCTION

> War is the realm of chance . . .. Chance makes everything more uncertain and interferes with the whole course of events . . ..
>
> If the mind is to emerge unscathed from this relentless struggle with the unforeseen, two qualities are indispensable: first, an intellect that, even in the darkest hour, retains some glimmerings of the inner light which leads to truth; and second, the courage to follow this faint light wherever it may lead. The first of these qualities is described by the French term, coup d'oeil [vision, wisdom]; the second is determination.[1] [Italics added]
>
> Carl von Clausewitz
> On War

A chance reunion occurred during field exercise SOLID SHIELD 85 while Exercise-Controller (Battleboard) communications were being installed at Camp LeJeune, Marine Corps Base, North Carolina. It had been almost a decade since last I had seen "Sparky" but my admiration for his communications-electronics (C-E) maintenance troubleshooting and repair talent had not diminished. And, on this occasion it was further reinforced. He was waist deep inside the minicomputer of one of the five-ton truck mounted C-E shelters comprising the Joint Tactical Communications (TRI-TAC), 300-line, Circuit (telephone, data, facsimile, etc.) Switch, AN/TTC-39. "Sparky" was there under the auspices of the Joint Tactical Command, Control and Communications Agency (JTC^3A) and the Project Manager, Multi-Service Communications Systems (MSCS), both of which are located at Fort Monmouth, New Jersey. Because the TTC-39 represents the third generation (digital) in a line of C-E equipment items dating back to the late 1940's., and the tactical subscriber community still has the first generation field telephones (i.e., TA-43, TA-312) as well as the "push-button" Telephone Set TA-838 or TA-938

era had elapsed, and first generation equipment was still in the Total Army inventory. He recalled that while at Fort Gordon in the late 1950's, he was shown pictures of what would eventually replace the outdated, and nonsecure FDM equipment. It is called PCM for Pulse Code Modulation, and its advantage over FDM is its ability to provide secure (bulk encryption) telephone, teletype, and facsimile data over 12 to 24 (vice 4 to 12 nonsecure) voice channels. Also, the 2 1/2-ton mounted shelter, Radio Terminal Set, AN/TRC-117 brought into being the vertically (vice horizontally) erected antenna system which could be threaded through the heavily forested areas of West Germany, where the vegetation can reach to heights of 110 feet. And, because of the Ultra High Frequency (UHF) radio characteristics of the TRC-117, absolute line-of-sight (LOS) had to be obtained between terminal sets no farther apart than 25 miles. Even at that range, and without trees, curvature of the earth required that antennas be erected to a minimum height of 70 feet.[2] The Career Management Field (CMF): 31 soldiers worked hard putting in those UHF radio "shots" in support of the SABER HAWK and WINTERSHIELD field exercise series in the waning months of the 1950's and early 1960's, especially during the Berlin Wall Crisis of 1961 and the Cuban Missile Crisis. "Sparky" recalled returning to the 32d Signal Battalion (Command Operations) 10 years later, after they had moved the bulk of their operations to Frankfurt. He had just come from an instructor assignment at Fort Gordon and expected to take charge of a Multichannel Platoon of PCM equipment. But, to his surprise, the old FDM equipment still had not been phased out. Most of the PCM equipment had been siphoned off to support the buildup in communications in Southeast Asia (SEA) which included equipping combat division and corps

(Field Force) signal battalions at 200-250 percent of table of organization and equipment (TOE) authorization. This extraordinary measure was needed to support the extensive SEA telephone and teletype switching network which exceeded the wildest imagination of doctrine or TOE developers, extending down to firebase and advisory camp levels. Not only didn't the TOE planners formulate the tables of authorization for this type of tactical(?) communications support, but, as "Sparky" quickly reminded me, the planners at US Army Training and Doctrine Command (TRADOC) did not take into account the need for Dial Telephone Central Offices (DCO's) at the Brigade Base-camp level either. Being at "Freedom's Wall" didn't have the same meaning as it once had, so "Sparky" swallowed his disappointment and made do with the minimum of resource support and still "got the message through" in the grand style of a tactical communications platoon sergeant. But, what particularly bothered all corps level communicators (and still does today) was that the distances over which they had to provide area communications coverage for all the combat support and combat service support organizations in a Corps area of operations was not matched with the proper equipment. Rather than the tactical antenna mast sections available, the 32d Signal Battalion and its sister elements at Corps and Field Army levels needed antenna towers (e.g., AB216, AB585, etc.) which could rise to heights in excess of 160 feet. As a lesson learned from Vietnam and from our NATO Allies: the wider the corps sector the greater the need for more redundancy in multichannel radio terminal vans, and the deeper the corps sector the greater the need for longer distances in radio shots (hence taller antennas that could support radio LOS ranges in excess of 50 kilometers (30 miles).[3]

As "Sparky" was approaching that magical 20-year mark in military service, the CMF 31 was expanded to include still another technology. The mid-1970's saw the advent of tactical microwave radio terminals (AN/TRC-138). Employing a nondevelopmental item (NDI), off-the-shelf radio, the AN/GRC-144, the TRC-138 was compatible with the PCM equipment, but employed Super High Frequency (SHF) technology in the 4.4 to 5.0 Gigahertz range, rather occupying the lower (and more crowded) UHF segment of the frequency spectrum. At these high frequencies, vegetation is like a "brick wall" to LOS radio shots. And, akin to the transmission of visible light, if LOS is achieved, shots of 80 kilometers (50 miles) are common and can be repeated at intervals to span distances in excess of 500 kilometers (300 miles). So it was that "Sparky" found himself, as a First Sergeant in a Signal Long Lines Company, and the proud owner of 16, TRC-138's. With the increased frequency spectrum usage, the TRC-138 was designed to carry a total of 96 (vice 24 for the TRC-117) channels of communications, but his PCM equipment was not of the "improved" second generation variety and therefore could only deliver 24 simultaneous channels, or 25 percent its capacity.

In his State of the Union message on 23 January 1980, President Carter changed forever the course of command, control, communications and intelligence (C^3I) in its research, development and acquisition (RDA), its manner of deployment, and its employment (i.e., <u>installation</u>, which includes the mechanics of equipment and antenna setup as well as the "initialization"[4] of subscriber-to-subscriber linkage; <u>operations</u>, which includes the switching of whole radio/wire systems or individual telephone, teletype, data, etc., channels; and, <u>maintenance</u>).

The Rapid Deployment Force and its follow-on joint command, US Army Central Command (CENTCOM) were given birth with the following words: "Let our position be absolutely clear: An attempt by any outside force to gain control of the Persian Gulf region will be regarded as an assault on the vital interests of the United States of America, and such an assault will be repelled by any means necessary, including military force."[5]

Together with at least one senior general officer who would not equivocate with his honor, "Sparky" retired from the military service prematurely, and joined the ranks of those outstandingly qualified tactical communicators, both officer and enlisted, who exit the technical combat support and service support branches because of the lack of professional job satisfaction and the perception that "no one at the top cares."[6] In the mid-1970's, General Robert G. Gard, Jr., writing on the interaction of the military and American Society said it all:

> Traditional values are not outdated; those vital to success in battle still must in inculcated in servicemen who will be required to engage in or support combat, both to ensure operational success and to prevent unnecessary loss of life . . ..
>
> Most destructive to morale in the armed services, however, is a lack of purposeful activity relevant to a legitimate military mission . . ..
>
> An increasing number of military assignments are not related directly to the combat function, removing the sustaining motivation of the military mystique. Genteel poverty and the Spartan life become less attractive, and the sense of commitment that engenders a willingness to work long hours is likely to become eroded when soldiers associate closely with civilians who are financially more successful in less demanding occupations.[7]

So it was that "Sparky decided to join the ranks of those in colorful baseball caps and logo-bedecked sport jackets who fill the

briefing tents of signal brigade headquarters in the field. They are the "tech-reps" and their legends grow concomitant with the growing complexity and sophistication of military C^3I and battlefield automation equipment. It is a rare occurrence during a 30- to 40-day deployment anywhere in the world that a tech-rep isn't seen assisting in the maintenance of a minicomputer-based C^3I or weapons system. Or, if not directly involved in the "hands on" repair job-tasks, then involved in the direct exchange or resupply of factory-shipped microprocessors, core-memory, or an adinfinitum assortment of printed circuit boards (PCB's), modules or subcomponents. Which leads one to wonder: "Will Federal Express be available in the Persian Gulf?"

During Exercise SOLID SHIELD, "Sparky's" assistance was needed on a component of the TTC-39 Automatic Switch, called in Intermatrix Unit (IMU). Because the Armed Services still have older generation equipment in the inventory, and will have well into the 21st Century, the IMU and other devices like it are required to make analog-digital-analog conversions in the 300-line switch. There are 36 such IMU's in the TTC-39, and they help span the technology-gap problem plaguing all the Services. The term: "hybrid" is becoming a part of every tactical communicator's vocabulary. The dictionary defines it as the result of combining things of mixed origin. In C^3I jargon it refers to the combining of analog (first, second, and improved second generation) and digital (TRI-TAC and third generation) subscriber terminals into a single data stream for transmission to another location. Sound complicated? It is, and is the single most prevalent factor causing Army Signal Corps units to enter the field exercise area anywhere from 10 days to 2 weeks in advance of the personnel manning the Tactical

Operations Centers (TOC's). Well before the decisionmakers or even the communications support personnel at the division level have departed their home stations at Fort Campbell, Fort Stewart, or Fort Whatever, the "hard-wiring" of the exercise begins. And, because of its extensive nature, no thought is given to adhering to doctrinal tenets such as maintaining sufficient C^3I resources for combat loss replacement and/or "jump" displacement to an alternate command post (CP) location; remoting of C-E equipment to reduce the emission signature of the actual tactical command post site; or organizing the CP so that staff and operating elements are dispersed and take advantage of natural cover and concealment.[8] Despite statements to the contrary, C^3I systems are not allowed to "mature with the exercise," and rather than relying on HF-Radio Teletype, Single-Channel tactical Satellite, and Combat Net Radio (VHF-FM) links to carry the subscriber traffic until the multichannel wire/radio network is installed the C-E folks are artificially sent to the field ahead of the "killers."

Who's at fault? The system is at fault. As Colonel (Ret.) Harry G. Summers, writing about the antecedents for the United States' defeat in Vietnam, summarizes:

> At least part of the answer appears to be that we saw Vietnam as unique rather than in strategic context. The misperception grew out of our neglect of military strategy in the post-World War II nuclear era. Almost all of the professional literature on military strategy was written by <u>civilian</u> analysts--political scientists from the academic world and systems analysts from the Defense community . . .. Even the Army's so-called "new" strategy of flexible response grew out of civilian, not military, thinking.[9]

It seems likely that the support of corps operations in an "immature" theater such as the Persian Gulf region was not fully

comprehended before the President's State of the Union pronouncement in 1980. In its aftermath we have witnessed a plethora of concepts, doctrinal and organizational changes, and recriminations both from within the Defense establishment and from without. Sometimes the acrimony has risen to the level that senior officers have taken to using pseudonyms (i.e., Major General Sam Damon and Brigadier General Ben Krisler, M. Ickon O'Clast, etc.) to describe the two versions of Field Manual 100-5: Operations (i.e., 1976 and 1982); the Army of Excellence (AOE); and the creation of light infantry divisions (LID's) to fight the AirLand Battle (ALB) in both a high-intensity conflict in Europe, Korea or the Persian Gulf, and a low-intensity conflict (LIC).

"Sparky" was not completely oblivious of the current ferment in military thought.[10] Like many other critics he saw two factors were undermining the credibility of the LID concept. First, the concept people (TRADOC) and the materiel developers had failed to field a viable light antitank weapon capable of being upgraded with preplanned product improvements (P^3I) to defeat the current or forecasted enemy armor threat. As a tactical communicator he learned a lesson from this shortfall that plagued the light infantryman: without strong advocacy, perseverance, and consistency in our technological approach to research, development and acquisition (RDA) and the Army Force Development processes, the soldier will go without the equipment and organizational structure he needs to succeed and survive on the increasingly lethal modern battlefield.[11]

Lacking advocacy for a mobile, radio-telephone system, akin to the commercial "cellular" radio packages installed in our private automobiles, the Army tactical (vice strategic) communications

community had been highly vulnerable to cost-cutting measures in the late 1960's. The civilian cost analysts in the Office of the Secretary of Defense (OSD) made a strong and convincing cost-effectiveness argument for the Army to join with the Air Force in the joint TRI-TAC program. Without a Mission Area Analysis (MAA) to effectively argue that the Air Force requirement would produce a "family" of equipment items which would be too bulky, too complicated, and beyond the Army's needs (e.g., 300-line versus 150-line automatic circuit switch), the Army found itself sharing the R&D and per unit procurement costs with its sister Service. Almost 15 years later, at a Battlefield Communications Review at the US Army Signal Center, Fort Gordon, GA in March 1984, the conclusion was reached that:

> the TRI-TAC materiel solution, in its existing form, [is] both unaffordable and too large to meet the transportation requirements of AirLand Battle [doctrine].[12]

The second factor undermining the rapid-response mission of the Commander in Chief, USCENTCOM (USCINCENT) in Southwest Asia (SWA) is joint and coalition tactical air operations command and control (C^2). Criticism of the Operation URGENT FURY (Grenada) for its lack of air-ground cooperation among the Services, will be nothing to the chaos which could result from trying to orchestrate (synchronize) the tactical air operations of four Service air forces and an innumerable number of aircraft resources from nations in the Persian Gulf region. Just the problem of positioning forward air controller aircraft, alone, will require a computer-based decision support system (DSS) capability. Akin to the air defense and field artillery battlefield automation systems (e.g., Missile Minder, AN/TSQ-73, PATRIOT, Advanced Field Artillery Tactical Data System (AFATDS), etc.) there is an immediate need for

digital voice/data information flow in the deep, close-in, and rear battle areas to collect and process sensor (e.g., E-3A Airborne Warning and Control System (AWACS), Joint Surveillance and Target Attack Radar System (Joint STARS), etc.) information and control the four basic missions of tactical air: Offensive/Defensive Counterair; Air Interdiction; Battlefield Air Interdiction (BAI); Close Air Support (CAS).

Inter-Service rivalries with regard to the forcible-entry strategy required in SWA have led to a suboptimization of the USCENTCOM mission capability.[13] The Navy and Marine Corps have long ago implemented effective air-ground operational procedures. In contrast the Army and Air Force are operating from the 24-hour preplanned air strike procedures that were applicable to the Southeast Asia, attrition-oriented scenario, but are wholly inadequate to the maneuver-oriented, fast-paced, AirLand Battle Doctrine. (NOTE: Field Manual 100-26: The Air-Ground Operations System was last updated in March 1973.) "Sparky" had witnessed for himself this lag in doctrinal development (and lack of advocacy) at the National Training Center (NTC). Because his commercial firm has the commercial activities (CA) contract for the automated battlefield at the NTC, he is most familiar with the latest technology in air-ground position reporting, low altitude navigation, identification, air corridor control, and C^3I data distribution on an area basis. He was amazed to find that although the Army was in the process of increasing its inventory of night vision goggles from 90,000 to 300,000[14] close air strikes at the NTC were still being conducted during daylight hours, only. He was further amazed by the Army's and Air Force's apparent disregard for automated support of analyzing,

processing, disseminating and continuously collecting digital data from sensor and operational platforms hundreds of miles distant from the front-line commander and the Air Support Operations Center (ASOC) collocated with the Corps TOC (CTOC). The fact that the Air Tasking Order (ATO) is a 20-30 section teletype message averaging 100 pages in length is perhaps one of the most significant factors contributing to the Air Force's reluctance to support Army CAS/BAI requests on other than 24-hour, preplanned basis. Also, the Bomb Damage Assessment (BDA) message is rarely received by the Air Component Commander's Tactical Air Control Center (TACC) in a timely manner to allow it to be factored into the next day's preplanned missions. Finally, he was amazed to find that in spite of our current assessment of the enemy's Radioelectronic Combat (REC) capability, the Tactical Air Control Party (TACP) is still using jammable, Combat Net Radios (CNR's) and places primary reliance on the High Frequency (HF) radio spectrum for calling in immediate CAS requests to Corps. Conservatively, HF radio transmissions can be detected and located by direction-finder REC equipment at a distance of 80 kilometers (50 miles).

Based on his knowledge of other Service and Allied Nation technologies, "Sparky" was of the opinion that CAS pilot's should be given distance and heading information, clearance to drop ordnance, and friendly locations not by lengthy voice messages from the forward air controller, but by digital data display. Operationally proven through its mission-support of AWACS, the Joint Tactical Information Distribution System (JTIDS) is in-hand technology which could not only increase the accuracy of CAS, but increase significantly the measure of troop safety. At the NTC, troop safety is at low risk. But, when

triple canopy jungle vegetation, the smoke and dust obscurants of the battlefield, and the nonlinearity of the Forward Line of Own Troops (FLOT) are factored in, the process becomes complicated. Coupled with the fact that CAS aircraft are low in priority for the Low Altitude Navigation and Targeting Infrared System for Night (LANTIRN) as indicated by the exclusion of the A-10, Thunderbolt II from the FY 1987 OSD Annual Report to Congress, support of LIC and high-intensity combat situations by tactical air resources requires more than just a review of state-of-the-art technology options. All factors considered, the TRADOC's Concept Based Requirements System (CBRS) with its emphasis on the systematic, Mission Area Analysis (MAA) process needs to be energized to correct these deficiencies. The first order of business is to determine which TRADOC Center should have proponency for Tactical Air Support.

"Sparky" was quick to add that the Army Signal Corps had a parallel not only in the force development-lag problem area, but also in equipment fill of authorized/required equipment in existing TOE's (i.e., C1 through C4 readiness ratings). As we were in a field location at the time, he asked a series of penetrating questions: How many square kilometers were being provided Corps area communications support? What were the longest UHF and microwave (SHF) radio links and, (because of a lack of doctrinal antenna height), how many isolated and potentially vulnerable relay terminal site locations were needed to extend these links both in breadth and depth of the Corps' area of operations? What was the status of the programmed upgrading of the SHF multiplex equipment to 96-channel operations? How many RATT and Radio Wire Integration (RWI) stations had been established to support the

synchronized, agile and deep maneuver of combat elements? What was the status of the signal battalion in receiving its TOE complement of 43 speech security devices (TSEC/KY-57) in support of the RWI mission?

His point was well taken. The issue was one of fidelity of large-scale maneuver exercises. The distances, pace of combat, disruptive effects of enemy Radioelectronic Combat (REC), NBC, and Spetsnaz operations, night movement to escape detection and air strike attacks, frequency of CP displacement, dispersion of the communications subscriber community, etc., were not being faithfully replicated during the Corps' field training exercises. If, for example, the 30,000 square mile area delineated by a rapid deployment mission area of operations were attempted by Active Army Signal Corps components alone, it would readily become apparent that the US Army Reserve (USAR) and Army National Guard (ANG) would be needed to provide minimally satisfactory customer service. Even the NATO Corps area described by Field Manual 11-92: Combat Communications Within the Corps would suffer degradation without USAR/ANG support, and it is prescribed to be only 13,000 square miles in area.[15]

Rather than providing a "backbone" communications grid network of 12 area signal center ("nodes") in support of a three-division force (16 nodes in support of a five-division force), in accordance with the Operational Concept for the Corps 86 Signal Brigade, it is a rare occurrence either in CONUS or in Europe to have an exercise supported by half that many nodes. Rather than being the "user-oriented" network consisting of minicomputer (vice microprocessor) driven automatic switches, UHF/SHF transmission equipment, and RWI stations at each node (to permit Combat New Radio/FM users to enter the Corps telephone system

for extended range and fast-paced offensive operations) the Corps area system is suffering from ossification.[16] Conditioned by the base-camp warfare of Vietnam which permitted voice (vice data or record traffic teletype) communications to coordinate operations, the user community has seen little need to hold the Army Signal Corps to its Corps 86 conceptual model for Corps communications support. Therefore, the backbone of the corps area system is the telephone, followed closely by the tactical digital facsimile machine.

Even though data and teletypewriter terminals provide high speed, error free, record traffic communications, and are efficient in the savings of C-E equipment (i.e., automatic switches, transmission channels, etc.) assets, the user has continued to prefer the inefficient telephone to conduct the AirLand Battle. Instead of struggling with the vast amounts of intelligence and target acquisition data through conventional push-button dial telephones, computer-based decision support system (DSS) technology is available to ensure success and C^3I system survivability on the battlefield. But, until the initial fielding of the tactical computer terminals (TCT) of the Maneuver Control System (MCS), any evaluation of user acceptance of battlefield automation will have to be deferred. Until the combat user at combat (battalion?), brigade, division, and corps level has worked with "user friendly" terminals employing noncommunications personnel, we won't know if he is ready for DSS technology. Beginning in 1987, we will begin to determine how long it will be before the combat arms community will be willing to give up laborious hand-copied voice message traffic, and their grease-pencilled, acetate-covered situation and operational status boards. The degree of user acceptance will largely be based on the

realization that our potential Soviet and Warsaw Pact adversary can cause us to react continuously to his operational level initiatives because he is now successfully harnessing the power of the computer microprocessor. As General William E. DePuy (Ret.) makes the case for improved C^3I system design:

> Recently there have been disturbing claims that the Soviets have set higher standards synchronization than has the U.S. Army. Suffice it to say that they seek to execute an operation at army level (a big U.S. Corps) five to six hours after receipt of orders. Even if it takes them twice as long, say 12 hours, they would not be the slow, sluggish organization we happily describe to ourselves. If we intend to operate inside his decision cycle we have our work cut out for us. Fast synchronization comes from good, simple procedures backed by reliable communications.[17] [italics added for emphasis]

Just like the antitank weapon for the Infantry, and the fact that night observation and distributed C^3I equipment is not yet available to support air strikes at the NTC, reliable communications are not available to support the four basic fundamentals of AirLand Battle Doctrine: Initiative, Depth, Agility, and Synchronization. We are lying to ourselves if we think that given the present structure (i.e., TOE authorizations and operational readiness fill of authorized equipment) we can successfully provide C^3I support for a land battle operation anywhere in the world and "operate inside the enemy's decision cycle." And, it is this self-deceit which engenders the dissatisfaction of critics. How does a senior noncommissioned leader live up to the soldierly values for: COMPETENCE and COMMITMENT when he constantly sees his troops engaged in less than purposeful job-task activities and activities which are not related to a combat support mission established by doctrine? How does he explain to the young soldier that his

equipment is too bulky and heavily dependent on contractor maintenance support to be considered for early deployment (or any deployment) with the contingency corps? How does he overcome the morale crunching effect of "training decay" when post (garrison) and other "palace guard" tasks take precedence over field training exercises that minimally must encompass "total system" assets (e.g., satellite, UHF, SHF, radio links automatic switches, etc.) and customer C^3I requirements that include TACFIRE, joint airspace control, target acquisition, and CSS terminal equipment. And finally, how does he instill a sense of competitive pride in his soldiers when the failure avoidance syndrome of his superiors overshadows the tasks, conditions and standards of the Army Training and Evaluation Program (ARTEP), he continuously finds his unit arriving in the field 10 days to 2 weeks before a field exercise STARTEX, and then the exercises bear no semblance to doctrinal precepts? There was a time when you could fool the soldier into believing anything. But, the perceptive critics know that those days are (thankfully) gone forever.

So it was with "Sparky" in the Spring of 1978, when he decided to hang up the uniform and seek a career which didn't have the conflict between what was taught in the "school house" and what was practiced in the real world.[18] At the time he made the decision to retire, he was assigned in his home state as a USAR advisor. In the packet of information he had received on his new assignment, was a copy of Training Circular 24-18: Communications in a "Come As You Are" War, fresh off the press in the Fall of 1977. At first he chuckled at the title of the TC After all, hadn't the Army Signal Corps been making do with a "mixed" bag of equipment for the past 30 more years. The TC

reminds one that Reserve Components (RC) represent almost half of the capability of the ground force, and in most instances

> don't have a complete fill of authorized communications equipment; and, what they do have may consist of both first and second generation equipment.[19]

The TC goes on to advise that the interfacing of both old and new equipment represents a particular challenge to the tactical communicator. But, from "Sparkys" two tours in Europe, he already knew that. He also knew from experience the challenge that having multiple generations of equipment has in the areas of maintenance, test equipment, prescribed load lists (PLL) of repair parts, etc., not to mention the interoperability problems with our sister Services and NATO Allies. The TC concludes that "current economic realities limit the amount of additional communications equipment that RC units can expect to receive. This means that, if mobilized, the equipment on hand is all that can be expected--in other words, a 'come as you are' war."

The purpose of this research paper is to determine the antecedents for us falling behind in C^3I employment doctrine, operational concepts, and materiel development so that, today, our earliest estimate for recovery will be with the fielding of the Mobile Subscriber Grid System (MSGS) capability with the fifth and last corps (I Corps) in Fiscal Year 1992. Chapter Two will explore those Concept-Based Requirement System (CBRS) procedures mandated by Headquarters, TRADOC, which if circumvented do not lead to an orderly and evolutionary flow of materiel from the Research, Development, and Acquisition (RDA) process. Many problems of interoperability, lack of inter-Service cooperation, and fixation on a limited number of feasible technological solutions to

an operational concept (i.e., TRADOC Pamphlet 525-series), can be traced to a breakdown in the CBRS at the TRADOC Center/School level. The last chapter approaches the problem from a materiel development viewpoint, highlighting those management tools e.g., P^3I, Logistics Support Analysis data, Continuous Comprehensive Evaluation (C^2E) during life-cycle testing, etc., which can be applied during the development of a C^3I or major weapon system program to determine early on if the operational effectiveness and operational suitability characteristics as outlined in the requirement document (AR 71-9) are going to be met at the time of operational testing (OT). Finally, we will look into what other junior and senior military men and civilians are writing in professional journals about computer-based decision support system technology, the ascendancy of embedded training (ET) techniques, and the absolute need for high fidelity Joint Readiness Exercises (JRX) to stimulate the "demand-pull" rather than "technology-push" of operational concepts at the Corps and Echelons Above Corps levels.

ENDNOTES

1. Carl von Clausewitz, On War, ed., and translated Michael Howard and Peter Paret (Princeton: Princeton University Press, 1976), pp. 101-102.

2. Department of the Army, Field Manual 24-21, Tactical Multichannel Radio Communications Techniques (Washington, DC: USGPO, October 1974) p. 3-9.

3. In lieu of antenna towers e.g., AB-216, AB-585, water towers and commercial television and microwave towers are frequently employed in order to achieve the maximum distance from each radio link and thereby conserve on radio terminal vans needed at relay sites. Safety is a factor. Soldiers are required to mount the "dish" antennas at heights exceeding 200 feet in some instances. Locally fabricated block and tackle systems are used.

4. Initialization refers to the synchronization or "hand shaking" between electronic equipment components that results in two subscribers successfully passing voice, data or facsimile traffic. Setup time on the other hand is that time required by the communications team upon arrival onsite to setup the equipment (i.e., antennas, power generators, perform preoperational checks, etc.) prior to initialization. Whereas setup is a factor of team discipline and performance to Skill Qualification Test (SQT) standards, initialization is a factor of C^3I equipment design. It is the inordinate time involved in initialization of "hybrid" (analog/digital) communications links which causes signal corps units, more than any other single factor, to enter the field well in advance of the field exercise players.

5. Donald E. Neuchterlein, America Overcommitted (Lexington: University Press of Kentucky, 1985), p. 123.

6. Human behavioralists tell us that all behavior is directed at satisfying a need and achieving a goal. One of the goals is competence. "People with this motive do not wish to wait passively for things to happen; they want to be able to manipulate their environment and make things happen . . . .[and conversely,] people with low feelings of competence will not often be motivated to seek new challenges or take risks." According to Robert W. White, "the competence motive reveals itself in adults as a desire for job mastery and professional growth. An individual's job is one arena where he can match his ability and skills against his environment in a contest that is challenging but not overwhelming." [Italics added] Material extracted from Paul Hersey and Kenneth H. Blanchard, Management of Organizational Behavior (Englewood Cliffs: Prentice-Hall, Inc., 1972), pp. 34-35. In the case of "Sparky" once he was no longer the master of his environment (i.e., the growing complexity of the C^3I mission), he sought a new career in which he could again achieve competence and job satisfaction.

7. Robert G. Gard, Jr., "The Military and American Society," National Security & American Society ed. Frank N. Trager and Philip S. Kronenberg (Manhattan: University Press of Kansas, 1973), p. 571.

8. The Army has no published operational concept on command post survivability. Three Army officers with faculty and staff experience at the US Army Command and General Staff College, Fort Leavenworth, KS surveyed and found that divisions in Europe move the Main CP every 36 to 48 hours and the Tactical CP every 12 to 24 hours. Colonel Richard M. Scott, USA, LTC Julian M. Campbell, Jr., USA, and LTC John R. Wallace, USA, "Command Post Survivability," Military Review. September 1982, p. 20.

9. Harry G. Summers, Jr., On Strategy: The Vietnam War in Context Strategic Studies Institute, USAWC, Carlisle Bks, PA. p. 1.

10. The following was extracted from an article tracing the Army's force structure (modernization) changes from the 1962 Reorganization Objectives Army Division (ROAD) to the current Army of Excellence (AOE):

Table Two

Shift in Doctrine 1976-1985

Factor	Active Defense (1976)	AirLand Battle (1982)
Primary war-fighter	Division commander	Corps commander
Focus	Tactical (battalion, brigade, division)	Operational (corps)
Combat style	Attrition	Maneuver
Orientation	Defense	Balanced between defense & offense

(Source: Brig. Gen. John C. Bahnsen, Jr., USA, "The Kaleidoscopic US Army," Armed Forces Journal International. November 1985, p. 82.

11. Rather than following TRADOC's Concept Based Requirement System (CBRS), it appears the combat development community has been bedazzled by the availability of multiple antitank weapon technologies (e.g., Viper, Rattler, Tank Breaker, etc.) and, although millions have been spent, still doesn't have a replacement system. Like the antitank development (Mission Area: Close Combat (Light)), the Automation-Communications mission area for which the US Army Signal Center, Fort Gordon, GA is the proponent agent, has been plagued by a lack of

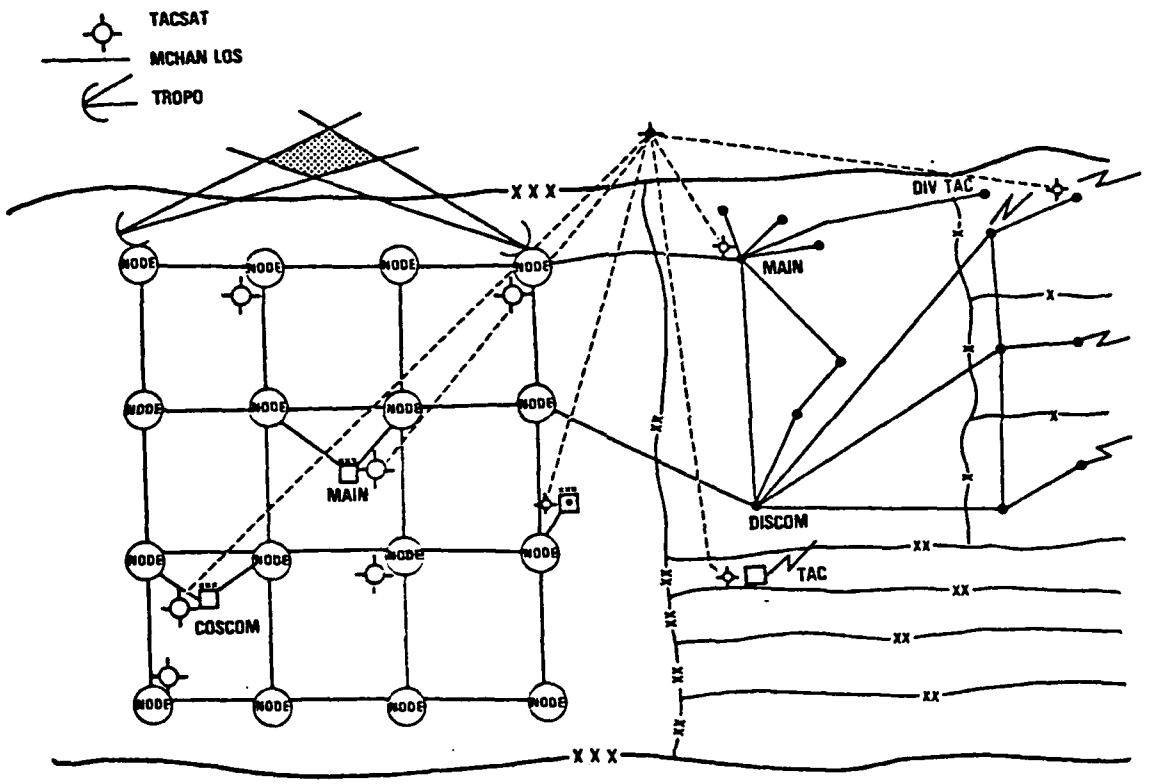
advocacy for a mobile, radio-telephone system at the division and corps levels. What has now become known as the Mobile Subscriber Equipment (MSE) a US Forces Command memo describes as a system "that will provide rapid emplacement, flexibility, reliability, electronic survivability, and security for voice, data, and record traffic." In the late 1960's, combat arms and C^3I community advocacy for a similar mobile capability (Project MALLARD) was nonexistent. Conditioned by the lack of corps level maneuver in Vietnam and a SEA point-to-point telephone network which remained relatively intact right up to the Fall of Saigon in 1975, Project MALLARD technology was allowed to migrate to Europe. (Refer to ANNEX A, TECHNOLOGY TRANSFER: An Economic Challenge to National Security.)

12. Letter, ATZH-CG, US Army signal Center and Fort Gordon, SUBJECT: "Battlefield Communications Review," 23 March 1984. The letter also included the directive from the Army Vice Chief of Staff to reduce the size of the Army Signal Corps by approximately 5,000 personnel spaces. This decision, reached in September 1983, was one of the "affordability" issues posed by continuation with the TRI-TAC technology at corps level and below.

13. The term "suboptimization" refers to the lack of cooperation among the military Services. Inter-Service rivalries, as perceived by the Congress, has prompted Senators Goldwater and Nunn to "propose overhauling the way weapons are bought and streamlining the allegedly cumbersome military chain of command." George C. Wilson, "Military Reorganization," Washington Post, October 15, 1985, p. A1.

14. "Army Awards Big Night Vision Jobs," Defense Week, October 15, 1985, p. 13.

15. The current operational concept for a corps area communications network is described in US Army Signal Center's "Operational Concept for the Corps 86 Signal Brigade," Fort Gordon, GA, July 1980. This document will in time be replaced with the doctrinal guidance contained in Department of the Army, Field Manual 11-92, Combat Communications Within the Corps Washington DC: USGPO, to be published. In the meantime, during this period of strategic and operational concept transition, the Integrated Army Communications System (INTACS) shows the corps area communications network as follows:



16. Structured under the Corps 86 concept, the 35th Signal Brigade deployed in late Summer of 1984 to southern California. The objective was to exercise contingency corps doctrine in a large immature theater area of responsibility (AOR) and in the air, desert climatic conditions and mountainous terrain stretching from San Luis Obispo County in the west to Fort Irwin in the east and then south over the San Gabriel Mountain Range into March Air Force Base. The exercise demonstrated the operational performance characteristics of the brigade's VHF, UHF, and SHF microwave radio equipment, and confirmed the fact that when line-of-sight (LOS) is achieved between radio terminals, VHF-FM (AN/VRC-12 Series) combat net radios will achieve 100 miles range using the ground plane antenna array, RC-292. The satisfaction of mission accomplishment was experienced by all soldiers who "survived" the desert and returned to Fort Bragg, NC 30 to 40 days later. Their emotional high was still being experienced more than a year later, when at unit picnics and other social or sporting events the GALLANT EAGLE 84 tee-shirt was still in evidence and the "war stories" still being told. But, once the backslapping subsided and the congratulations were given and accepted, the realization of what we didn't accomplish became evident and should serve as a guide to future LITE-type (Large Immature Theater Exercise) operations. Althougn approximately 30,000 square miles were provided with area communications support subscriber locations were concentrated into only a few locations. Compounding the problem of artificiality, the division and Corps Main CP's were not displaced during the exercise. The Corps Forward CP, located approximately 220 miles forward of Corps Main, was established without any consideration given to using the available cover and concealment offered by natural conditions (e.g., hill masses, river bed "washes" etc.). Instead, the Corps Forward was situated among a forest of C-E antennas and large heat-producing power generators. The mountains selected for "isolated" radio relay sites were well served by improved secondary roads, thereby not stressing the logistics system in their resupply of water, rations, or POL. No restriction was placed on the use of the road network or travel during daylight hours, which prompts one to think about the possibility of having to use helicopter-lift assets to occupy mountain relay sites, at night, and then maintaining a resupply operation and emergency reaction force capability. If more realism isn't interjected into large-scaled maneuvers like the GALLANT EAGLE series, we will never begin to appreciate the enormous difficulties of ensuring the survival of LOS communications links, but more importantly, the survival of the decision-making capability located at Command Posts.

17. General William E. DePuy, USA (Ret.), "Toward A Balanced Doctrine: The Case for Synchronization." Army. November 1984, pp. 23-24.

18. The III Corps has instituted a new version of individual soldier training called Army Training and Evaluation Program-Based Qualification Testing (ABQT). The focus is on combat, and everything else is secondary. In an environment where high personnel turnover rates are a given, Colonel D.M. (Mike) Malone reminds us that "competence is the basis for skill and for confidence in oneself, which is where courage comes from. Competence is also the basis for confidence in others, which establishes commitment, since the patterns and strength of trust and [cohesive] mutual support are formed . . . ." Quote from: Colonel D.M. Malone, USA (Ret.), "An Army of Excellence," Leadership and Management Technical Area Working Paper 83-1, US Army Research Institute for the Behavioral and Social Sciences, Fort Leavenworth, KS, 25 April 1983, p. 62.

19. Army Training Circular (TC 24-18), Communications In a "Come as You Are" War, (Department of the Army, September 1977), p. 1-2.

20. Sherman Gee, Technology Transfer, Innovation, and International Competition (New York: John Wiley & Sons, 1981), pp. 9 and 11.

CHAPTER I

STRATEGY AND STRUCTURE: A View From An Evolving National Policy/ Military Strategy Perspective

> History is the record of man's steps and slips. It shows us that the steps have been slow and slight; the slips, quick and abounding. It provides us with the opportunity to profit by the stumbles and tumbles of our forerunners. Awareness of our limitations should make us chary of condemning those who made mistakes, but we condemn ourselves if we fail to recognize mistakes.[1]
>
> B.H. Liddell Hart
> Why Don't We Learn From History?

INTRODUCTION

A recent article appearing in the January 13, 1986 issue of the Washington Post quoted a Korean War veteran as saying, "we're in the same situation today, . . . nobody gives a good goddam about the infantry."[2] The article was titled, "Infantry Still Can't Kill Tanks." As early as mid-August 1943, the World War II antitank weapon, the 2.36 inch "bazooka" was proving itself ineffective against the frontal armor of German Panzers. Whereas German technology had produced a Panzerfaust series of antitank weaponry which kept pace through product improvements with the heaviest Allied armor, "at least seven years had passed and the U.S. Army still had not fielded an improved version of the weapon it had [originally] invented. This gives a slight hint of the seriousness of the seriousness of the [research,] development and acquisition problems facing the Army today. Indeed, the problem seems to be getting worse . . . it apparently now takes us 12 years to develop and field a major system."[3]

But the high frustration level, illustrated by the Washington Post

article isn't confined to the length of the RDA and Army Force Development processes alone. The combat and materiel development people have a number of "fixes" for shortening the development process and prioritizing a force structure mix through the Planning, Programming, and Budgeting System (PPBS). Considering the frustration that existed after WWII, after having suffered the humiliation of having to use captured German-made Panzerfaust weapons to defeat enemy armor, it is inconceivable how the Army found itself totally unprepared in 1950. In a recent article in Army, General Wm E. DePuy relates the story of LT Ollie Connor, who in the early days of the Korean War, fired 22 bazooka rockets at a column of soviet-made T-34 tanks without any effect. As General DePuy concludes, "In 1950, our eyes had been on the atomic bomb, the strategic air command, on the unlikelihood of any more wars fought by light infantry . . . . Today, our eyes are fixed on outer space, on an export war between machines; scientists, not soldiers are thought to be required. Watch out, Ollie Connor!"[4]

When General DePuy addresses the issue of parochialism and inter-Service rivalries, he brings to mind another Army article that in early 1980 chronicled the testimony of General Volney F. Warner, Commander of US Army Readiness Command (USREDCOM), before the defense subcommittee of the House Appropriations Committee. The Congress had been sensitized by Marine Lt. Gen. Paul X. Kelley's remarks to the press that the Rapid Deployment Joint Task Force (RDJTF), the forerunner to USCENTCOM, "would be primarily a Marine Corps enterprise . . . ."[5] The article had the title: "The 'Unpleasantly Familiar Sound of Tom-Toms' Beclouds RDF Plans." Compare this title with one in the Time magazine more than 5 years later, "Drums Along the Potomac," and we see that it is not a

straight forward problem in correcting the perception that "nobody gives a good goddam about the infantry." As the Time article states:

> The Air Force, for instance, is chronically unwilling to provide air cover for ground troops in the field, and the Navy is reluctant to buy ships to transport the Army. Turf battles surface most glaringly in actual combat. The invasion of Grenada was a walk-over, said Senator Nunn, but only because the defenders were few and poorly armed. Coordination among the services was abysmal.[6]

Whether Congress has an accurate picture of the URGENT FURY (Grenada) operation is of little importance to the soldier whose success and survival in combat depends on the Army Force Development process to provide him with the best materiel, doctrine, organization, and joint service support that is affordable. The purpose of this chapter is to focus on the historical and political aspects of the apparent disconnect between what is state-of-the-art and technologically feasible, and what ends up in the hands of our soldiers. The problem has been particularly critical in the last decade for Command, Control, Communications, and Intelligence (C^3I) systems, and the field of computer-based, decision support systems (DSS). Faced with tactical and operational (Corps/Theater) C^3I) systems that had been developed with insufficient consideration given to inter-Service interoperability, networking, and the cross-attachment of units with our NATO Allies, the Army is again having to look to foreign-developed technology (e.g., Mobile Subscriber Equipment) for a solution. As with the German-made Panzerfaust in WWII, the Swedish-made AT-4 is purported to be the replacement for the M-72A3 Light Antitank Weapon (LAW). For 10 years the programmed replacement for the LAW has been the VIPER rocket launcher, "but the desired performance could not be achieved with the severe weight limitations and development was halted in 1983."[7] Because of the impact that

technologies like the MSE and LAW have on the Army's emerging doctrine in the employment of the light infantry division (LID) and the RDF, the conceptual framework for this chapter is: that technology is both a determinant and a result of national policy and military strategy concepts.

STRATEGY, STRUCTURE, AND TECHNOLOGICAL CHANGE

When President Truman committed forces in June 1950 to blunt the North Korean advance into South Korea, he was unaware of the ineffectiveness of the 2.36 inch antitank weapon against Soviet-made armor. Photographs of that period, when one of the new T-34's (the T-34/85 with the 85mm gun) is shown knocked out, usually reveal that North Korean armor was destroyed by bombing, specifically by napalm bombing.[9] Also, a miscalculation by the Allies in both World War I and World War II concerning the devastating effect of the machine gun as an offensive weapon and the technological advances demonstrated in the 1940 Blitzkrieg point out the fact that "technology is a major variable in the interaction of influences that determine [national] security policy."[10] The following quote illustrates that a balance must be struck between strategy and structure in formulating national security policy:

> . . . any major decision about it influences and is influenced by both international and domestic politics. Strategic decisions are made largely in response to perceived threats in the international environments; they deal primarily with commitments, deployment and employment of military forces, and the readiness and development of military capabilities. Structural decisions are made most in terms of domestic politics and deal primarily with budget and force decisions on defense personnel, materiel, and organization. The two types of decisions interact at all levels. Strategic decisions "determine" the force structures required to implement them, yet the resources made available

> through structural decisions limit the extent to which strategic decisions can be made. [Italics mine][11]

And, remembering that technology normally precedes force integration (materiel fielding) by at least 10 to 12 years, national military strategy is a "risky business" at best if all the military factors, and domestic and international politics are not considered in sufficient detail.

1945-1953: Development of Containment National Policy

Following World War II, national policy reflected what the American people had always felt was an adequate defense. Given its advantages of geography and potential industrial capacity, as well as the advent of the atomic bomb, the United States pursued a policy of force mobilization to meet any future threat. This feeling of relative security was short lived. "In 1949, two . . . dramatic events affected the formulation of US security strategy. In August, the USSR exploded its first nuclear device . . . [and] in late 1949, the Communist Chinese completed the conquest of the mainland, creating the appearance of a monolithic communist adversary from Central Europe across the length of the Asian continent."[12] Mobilization soon gave way to Containment policy as a check on Soviet expansionism. The creation of the North Atlantic Treaty Organization (NATO) was a clear example of the United States recognizing the need for standing military forces to deter aggression and "reflected the acknowledgement of the realities of international and technological affairs."[13]

One technological area that had been disregarded in the intervening years between the end of WWII and the Korean War was Close Air Support (CAS). After having seen the devastating effect of the Luftwaffe in support of ground forces in the Blitzkrieg and later in North Africa, by 1944 US Army air-ground procedures were formalized in Field Manual 100-20: Command and Employment of Air Power. Despite a rocky beginning in the Mediterranean in November 1942 during Operation TORCH which saw "ground commanders complain[ing] bitterly that they seldom saw an American plane" by 1944 during the breakout on the European Continent:

> . . .General Patton, as his Third Army raced to the Seine, was ready to entrust the safety of his open southern flank to the XIX Tactical Air Command. The most talked-about development during the breakout in August was the air-tank team in which an air controller sat with the commander of an armored squadron in the "point" tank, equipped with a VHF (very high frequency) radio, and exchanged requests, warnings, and intelligence with planes overhead detailed to provide the armored force with cover and "armed reconnaissance." . . . The collaboration of air and tank crews was the outstanding success in air-ground co-operation in Europe . . . . The two services were at last learning how to work together . . . . Co-operation throve in a soil of daily association and mutual understanding. Air commanders, as well as the pilots put enthusiasm and energy into making the new arrangements work.[14]

By 1950, the air-tank team concept and its procedural doctrine were largely ignored. Just as the American soldier faced the hordes of Germans and Italians pouring into Tunisia without adequate CAS, so it was on 24 June 1950, when the Democratic Peoples' Republic of Korea (DRP) invaded the Republic of Korea:

> Air Force support operations were handicapped because the newly independent Air force had neglected tactical air support while concentrating on readiness to deliver the atomic bomb, and the Fifth Air Force and Eighth Army in Japan in particular had not carried out exercises in air-ground coordination.[15]

Like the light antitank weapon, air-ground operations in recent military history are marked with peaks of frenzied support and inter-Service cooperation, followed very closely with professional conduct that borders on total incompetence and criminal neglect. It is little wonder that the Services' staunchest supporters in the past are now beginning to hammer at the age-old problems of parochialism and lack of advocacy for those basic principles of conventional warfare which have proven themselves to be close (vice deep) battle combat power multipliers of incalcuable potential.

But during the Truman administration, recognition of the threat, the establishment of national security policy and strategy, and response to it in terms of force structure decisionmaking proved to be widely diverse areas. For in the early 1950's, NATO was outnumbered by Warsaw Pact forces by three-to-one, and at the same time the "American public was becoming increasingly sour on the war in Korea."[16] The only military strategy open to the NATO Allies was one that came to be termed, "Fallback." "Plans called for a general fallback, covered by a series of mobile screening actions, in which the Rhine River would be used both as a position behind which the retreating forces could stabilize as a formidable redoubt . . . .Depth would be achieved by the resistance in the delaying zone, which could be counted on to last long enough for the effects of the American strategic bombing of the Soviet Union to filter down to the front."[17] [italics, mine] Preoccupation with the Korean War, misconception as to the ability and potency of long-range strategic bombing, a cut-back in the military budget and stretched out RDA programs augured ill for C^3I systems in the European Theater. For example, the "new family" of Frequency Modulated (FM)

radios and the long-range Amplitude Modulated (AM) radios were in prototype configuration in the early 1950's, but domestic spending priorities and high-priced weapon systems precluded their procurement in large numbers.

The FM and AM radio example illustrates the fact that for the past 40 or more years, C^3I procurement programs have received short shrift in the annual Defense Budget. And, when a replacement system does make its way through the RDA process, rather than fielding it at 100 percent of tables of organization and equipment (TOE) force structure, the procurement "pipeline" is not completely bought out. One cause of this is program stretch-out. A more recent example is the single Channel Ground and Airborne Radio-VHF (SINCGARS-V) which is currently scheduled to replace the existing (i.e., VRC-12 series) combat net radio (CNR) system. It is 1970's CNR technology that won't be completely fielded until the mid-1990's. In the meantime, production line models of the M-1 Abrams tank and Bradley Infantry Fighting Vehicle (IFV) are being fielded with the old family CNR which are out of production. Hopefully, the SINCGARS-V won't meet with the same fate of other C^3I procurements which were spread over a number of years, so that when only 50-60 percent had been purchased, the remaining equipment items had become too expensive from the effects of inflation. As with the VRC-12 series, the decision was made several years ago to stop the procurement and again "make do" with the old family of equipment until the next cycle (new generation: SINCGARS) of more advanced design was available through the pipeline.

1953-1969: The Policies of Massive Retaliation and Flexible Response

The advent of the Eisenhower administration in the early 1950's did not result in a dramatic increase in defense spending. In fact the Eisenhower New Look program "resulted in further reductions in conventional forces . . . [and a] decision to place very high reliance upon nuclear weapons. Strategic air power became the mainstay of the US deterrent posture, and tactical nuclear weapons were to be used to replace the reduced levels of conventional forces in forward defense areas."[18] Thus firepower, some 7,000 nuclear weapons in NATO to be counted on "to counter an attempted concentration of [Warsaw] Pact forces for a conventional breakthrough."[19] Although the defense line was no longer along the Rhine River, the "Trip Wire" strategic concept for the defense of Western Europe did not demand the depth or mobility to necessitate any change in the basic technological design of C^3I systems. Therefore it is natural to assume that the RDA community had little incentive to design any communications-electronics (C-E) to be significantly smaller, lighter, or more quickly installed. Advocacy had not been established for the C^3I system designated to support the 108 PERSHING, MGM-31A, mobile, nuclear guided missile launchers deployed in Europe through 1971. Instead, the field artillery pursued their own development of a tropospheric-scatter, microwave (SHF) system which later proved a liability due to its poor operational performance, high support requirements and distinct "electronic signature."[20] Defense (vice maneuver) oriented, Army tactical communicators were not possessed with sufficient vision and tactical "horse sense" to modernize tactical C^3I equipment. Therefore, equipment assemblages continued to remain

basically the same as their WWII predecessors: 2 1/2-ton truck mounted, complex in operation, and manpower-intensive for its operation and maintenance. Although improvements were made in antenna systems for ease of erection, installation (setup and initialization) times for establishing a network grid in support of a combat division or corps did not decrease. This latter aspect is attributable to the addition of secure encryption devices to the Pulse Code Modulation (PCM) equipment which represented the Signal corps' second generation of multichannel equipment.

By 1956, New Look's reliance on tactical nuclear deterrence was losing credibility as a global security strategy. The buildup of Soviet nuclear capabilities and the need to develop a limited-war strategy tested the existing national policy.

> Largely as a result of inflation, defense costs were rising. Confronted with a choice between increasing the national debt or reducing military spending, the Eisenhower administration chose the latter . . .. In constant dollar terms, military spending was less in 1960 than it had been in any year since 1951 [21]

The onset of the Kennedy administration (1960) resulted in improvements in conventional force capabilities. The Flexible Response strategy was in recognition of the fact that,

> if the United States were to respond with an appropriate level of force to a wide variety of challenges, its conventional forces would most likely be the ones used. Neglected under the policy of Massive Retaliation, these force capabilities had to be improved and modernized.[22]

Under this shift in security policy, the Army expanded from 12 to 16 divisions and the counterinsurgency role of the Special Forces was greatly enlarged. The need for stronger conventional forces was recognized by the NATO nations and the strategy of Flexible Response

became official NATO policy in 1967. But that did not mark an immediate shift in the concept of mounting a forward defense in Germany nor in deferring the options of resorting to tactical, theater, and possible strategic nuclear weapons. It would not be until the mid-1970's before a shift from tactical nuclear weapons was detected. Part of the reason was that,

> US efforts to introduce flexible response doctrine into NATO strategy initially encountered Allied resistance. Any shift to primary reliance on non-nuclear forces was certain to cause uneasiness among the European members of the alliance, who feared erosion of the nuclear deterrent.[23]

Even if the NATO Allies had embraced the Flexible Response strategy there were other factors at work which would not have hastened a Forward Defense concept for Western Europe nor an RDA effort for improved C^3I systems to support such a strategy shift. One of these factors was the growing cost-consciousness of defense weapon system purchases in the Federal Government. Another factor was the increasing commitment to Southeast Asia.

> For almost two decades [since the Mid 1960's], however, the military acquisition procedure has been reshaped to reflect new civilian cost consciousness. Although many of the policies, associated with the activism of OSD [Office of the Secretary of Defense] have had debatable results, the evidence is persuasive that service interest have lost primacy in making procurement decisions.[24]

In Chapter III, we will examine the RDA management techniques the Army is employing to once again regain OSD and Congressional confidence. Sufficient for now to recall that

> from 1957 to 1970, for example, the services lost more than eighty major weapon programs for which they [had] spent $12 Billion.[25]

Author Millett characterizes the early Kennedy administration years; as

having

> demythologized the JCS [Joint Chiefs of Staff] and relied on Robert McNamara as their authoritative spokesman. For about three years, McNamara in turn dazzled congressional committees, but then his personal style and some unpopular cancellations of military programs and the failure of others tarnished the secretary's reputation for omniscience.[26]

One of the Army's C^3I programs which met the fate of the OSD cost analysts' "chopping block" was the international RDA effort called MALLARD. In the late-1960's and early-1970's, Army decisionmakers weren't as concerned about the operational art of warfare, battlefield agility and depth, or the fact that the Army Signal Corps was growing in strength and would soon eclipse the Infantry as the largest branch, as they are today.[27] If they had been, then the Corps and division area (vice point-to-point) communications system described by MALLARD would have continued as a *US/British/Canadian/Australian development*. Instead, the British continued to pursue the MALLARD-technology as an independent effort which they called PTARMIGAN. The French, on the other hand, deployed a similar system, RITA (an acronym meaning Automatic Integrated Transmission Network), with the First (Fr.) Army Corps in Northeast France and the Second (Fr.) Corps in Germany. Forming a grid network system of radio relay nodes (25 to 40 kilometers between nodes), and cellular-radio terminals not unlike the commercial systems for private automobiles, the RITA has been demonstrated to have:

> . . .the highest data transmission speed of all field automatic communication[s] systems: 48,000 bits per second per channel. [Mobile radio: 19,200 bps.] This speed is a thousand times faster than of World War II systems. Using RITA, a wire subscriber can reach another subscriber [within a Corps' area of operations] in less than three seconds, going through a complete . . .communications system without knowing where the other subscriber is

> located and without regard to the status of the system (for example, traffic load, destroyed [node] elements.[28] [italics added for emphasis]

Rather than pursuing cellular-radio technology, the Army was directed by OSD decisionmakers and Joint Chiefs of Staff memoranda to join with the Air Force in pursuing a minicomputer-based automatic telephone and teletype switching network to satisfy subscriber needs in a hybrid (analog/digital) transitional environment. Without the conceptual framework of an Active Defense (1976) or AirLand Battle (1982) rebut the analyses of DOD, the Joint Tactical Communications (TRI-TAC) Program was established by DOD Directive 5148.7 in May 1971 "to coordinate the development and assure the interoperability of tactical communications equipment to satisfy service and joint requirements.[29] More than 3 years later, on 24 December 1974, the Joint Chiefs of Staff approved a Joint Operational Requirement (Army ROC 0853/USAF ROC 11-74). Commenting on the change in land warfare concepts and doctrine toward "smaller, lightweight, more mobile equipment" and the fact that the TRI-TAC R&D effort had cost $700 million through 1984, Mr. Donald C. Latham, Deputy Under Secretary of Defense for C^3I since July 1981, is reported as having described:

> . . .TRI-TAC as a "whopping disappointment," noting that the program has 10 years in the process. So, in fact was the hardware, with the system still not yet in the field . . ..[In the future,] from corps level down to battalion, Mobile Subscriber Equipment (MSE) would be the rule.
>
> Technologies available 10 to 20 years ago made the Army commander heavily dependent on the location of his communications [i.e., LOS, manual switching, etc.]. It is not an exaggeration to say that the [tactical] communicator in that era was the alter ego of the commander. The commander could not make

> tactical decisions without considering the availability of communications . . ..
>
> The communications tail was wagging the command dog. Both the British and French recognized this and set out to do something about it. In the process, the emergence of the microprocessor [vice minicomputer] permitted the functional [C^3I] distribution of the system to place its computing and processing at the scene [i.e., at the user terminal location and not in the hands of tactical communicators; hence the reduction in Signal Corps' personnel spaces as directed by the Army VCSA in September 1983].[30] [italics, mine]

Even if we assume that an unlimited defense budget line were to have existed for tactical C^3I systems procurement in the Kennedy-Johnson era, conventional force needs would have still be slighted. The Communist forces Northern Central Plain of Germany were not the priority threat. Instead, the buildup in Vietnam was taking precedence. Between 1966 and 1968, at a cost of $500 million, the Integrated Wide Band Communications system (IWBCS) was being installed as the "backbone" multichannel communications system for Southeast Asia. Employing troposheric-scatter (with upwards of 240 channel-capacity), long-range High Frequency (HF) Radio, and submarine cable technologies, the IWBCS was capable of linking a tactical battalion firebase commander in Vietnam with the Philippines, Guam, Hawaii, the Pentagon, or anywhere else in the world-wide network. But, the price was high; not only in dollars, but in diverted C-E equipment assets from other operational theaters, and the extremely large overhead in military and civilian communications personnel. As Martin Van Creveld writes,

> the increase made it possible to multiply the number of communications channels to each divisional headquarters fourfold, from eight in Korea to thirty-two in Vietnam. Multichannel VHF [normally 12 telephone or teletype channels] was now extended

> to units as far down as artillery batteries, and such outfits as the 1st Infantry Division were provided with thirty-five sole user ["hot lines"] terminating in the operations room over and above the normal complement of signal equipment.[30]

Van Creveld's thesis is that the proliferation of communications channels did not result in better command and control (C^2), an argument we will explore in a later chapter. For now, it is important to recall that the 1st Signal Brigade

> was a force larger than a division, whose 23,000 troops constituted fully 5 percent of all U.S. troops in the country,[31]

and the fact that in order to establish approximately 150 communications nodal[32] sites throughout Vietnam,

> an estimated one-third of all major items of equipment brought into the country consisted of electronics communications gear, and over half a million different kinds of spare parts for this gear had to be stored.[33]

With this type of buildup, it is easy to see why Western Europe was put on the back burner in terms of military doctrine and materiel.

It is easy to see why our NATO Allies (almost unilaterally) proceeded to refine the Flexible Response strategy into a subconcept of operations capable of mounting a forward defense of Germany. This NATO subconcept would become "part of Supreme Headquarters, Allied Powers, Europe's (SHAPE's), overall conventional concept of operations, . . . entitled FOFA [Follow-on Forces Attack]."[34] Lacking strategic depth, FOFA is but one concept among many others designed to "overcome conventional shortfalls and . . . [exploit] promising technology developments."[35] The total effort in the late-1970's would lead "the strategic community to search for ways to break the nuclear

stalemate by reexamining conventional strategies and by ending the long-term neglect of military operational [art] issues."[36]

1970-Present: NATO-The Search for a Realistic Military Strategy

To understand why our NATO Allies pursued an independent path in applying flexible Response strategy to conventional warfare, and why US Army doctrinal publications didn't detail the Active Defense operational concept until the mid-1970's, we must go back to:

> early in the Kennedy years, when the limited-war strategist General Taylor was at the height of his influence, the February 1962, edition of the Army Field Service Regulation (FM 100-5) had dropped the familiar statement: 'the ultimate objective of all military operations is the destruction of the enemy's armed forces and his will to fight.' Significantly, General Taylor, the limited-war strategist, objected from his post in Saigon when Washington dropped the enclave strategy for American ground forces in Vietnam and moved toward the search-and-destory strategy . . ..The Joint Chiefs and General Westmoreland preferred to proceed as though the Field Service Regulations had never changed--'to destroy enemy forces,'--to invoke again the old strategy of annihilation.[37]

But, mounting U.S. casualties soon spelled an end to risk-taking, instead a failure avoidance syndrome prevailed. In such an environment, how could any innovation take place in the Army Force Development process with regard to C^3I, let alone antitank weaponry, air-ground strike operations at night, etc. Instead, the concept and supporting doctrine of maneuver warfare with its emphasis on mobility and pursuit of the enemy gave way to the strategy of attrition.

> Infantry units were all but forbidden to practice their traditional mission of closing with and killing the enemy. Instead, maneuver elements found the foe while firepower eliminated him. B-52 usage, for instance, leaped from sixty sorties a month in 1966 to over eight-hundred monthly in 1967.[38]

The reversion to the enclave and attrition war strategies in Vietnam has had a far-reaching effect. As author Dave Palmer summarizes,

> only after leaving Vietnam and becoming army chief of staff, would General Westmoreland recognize the long-range danger. The fighting in Vietnam, he later admitted, produced a 'defensive, stereotype, tactical philosophy.' He labelled it 'firebase psychosis' [adding that it] will require reorientation to overcome such doctrinal narrowness.[39]

In the meantime, a reappraisal of the Soviet threat and the onset of the Nixon administration resulted in a redefinition of national security policy in 1974.

> American NATO forces--which had been stripped of personnel and equipment during the Vietnam War--were strengthened and reequipped. Additionally, the United States abandoned the so-called two-and-a-half war strategy and began to maintain forces based on a one-and-a-half war strategy . . ..The NATO commitment became the primary planning contingency for structuring U.S. Conventional forces . . ..[40]

How, in the past 10 years, this recommitment to NATO has been translated into the concepts of Forward Defense and Active Defense, and into revised doctrine[41] will be the topic of the next chapter.

CONCLUSIONS

Since World War II, the United States has grappled with its national security policy and resultant military strategies. No other operational theater reveals the dynamics of strategy change more than Western Europe and the US's mercurial commitment to military operational (Corps/Theater) level issues and the ultimate convergence of AirLand Battle doctrine with the Supreme Allied Command Europe's (SACEUR) concept of Follow-On Force Attack. And, no more evident than in NATO are the forces of international policies, military concept and doctrinal

developments, diplomacy, and domestic priorities on the formulation of military strategy. Technological advances, also, have had a key role in shaping strategy. The atomic bomb permitted the United States to pursue a strategy of mobilization (vice standing forces) in the late 1940's. The advent of tactical nuclear weapons permitted the Eisenhower administration to focus on domestic spending priorities by paring down the levels of conventional forces-in-being. But, strategy decisions have normally preceded technology and structural changes over the past 40 years.

The Rapid Deployment force is just one example of a presidential administration promulgating policy before the materiel and support structure needed to execute military strategy was available. The "deep attack" capability of the AirLand Battle concept is another case in point. Espousing a concept does not result in widely accepted doctrinal precepts and established procedures. The ALB concept's acceptance by NATO as doctrine

> under current program funding, the fielding of munitions, delivery platforms, and target acquisition systems necessary to complement the forward defense belt with conventional interdiction delaying zone will not likely come until the late 1980's.[42]

And, so it has been with tactical C^3I systems development and procurement; it, too, has lagged behind strategy and doctrinal change. And the future is in doubt. Cost-consciousness and civilianization of the RDA process has lead Allen Millett to conclude that

> the sets of control created in an accumulative manner since the early 1960's have become so vast and cumbersome that defense planners and independent analysts now wonder if the Department of Defense needs another organizational reform in order to give greater military voice in the weapons procurement process.[43]

Whether we believe that DOD needs reform is a moot point. What is of import to us is Allen Millett's enjoinder that we military professionals assume a more proactive and assertive posture in the force development and RDA processes of our respective Services. Whose fault is it that the Infantry is still without a satisfactory follow-on replacement for the LAW or DRAGON antitank weapons? Can the JCS or OSD be faulted for denying the Army continuance with the MALLARD technology in the 1970's when there was no advocacy within the combat arms for a mobile, radio-telephone system capable of transmitting data, not just voice and teletypewriter communications? Can the Air Force be criticized for lobbying for the Army's participation in TRI-TAC, particularly when one considers that minicomputer and hybrid transmission technology was the way we were communicating in Southeast Asia? And finally, can our sister Services be faulted for denying ground forces the latest in C^3I and night vision technology for Close Air Support aircraft, when historically and "chronically" the deep attack of Air Interdiction (AI) has received prioritization in the PPBS. It's a fact, that where a Service spends its Defense Budget dollar, there too lies its strategic and structural interests. If we in the Army are content to acquiesce in this, then for the near future, airstrikes at the National Training Center will continue to be daylight attacks, only, and guided by the jammable, voice (UHF) radio links that existed at the outbreak of hostilities in the Republic of Vietnam.

However, assertiveness alone is not enough. The past 15 years have been marked with vacillation in defining how to implement the Forward Defense concept. The inherent appeal of the Flexible Response strategy, aside, the fact remains that it and its spin-off operational concepts

(e.g., Active Defense, Follow-On Forces Attack, AirLand Battle, Joint Attack of the Second Echelon, etc.) have not resulted in a clear-cut "blueprint" for an operational theater that is characterized by a lack of strategic depth. But, should we expect more from an Army that only 10 years ago was fighting a war of attrition, whose field manuals eschewed the phrase: "the ultimate objective of all military operations is the destruction of the enemy's armed forces and his will to fight,"[44] and whose tactical C^3I systems were being employed to support a defense-oriented, enclave strategy in Southeast Asia? No, we should not. But, this does not diminish the magnitude of the challenge which faces us now; to prepare ourselves doctrinally and materially to fight the First Battle of the next war.

CHAPTER I

ENDNOTES

1. B.H. Liddell Hart, Why Don't We Learn From History? as quoted by Rear Admiral Henry E. Eccles, USN, (Ret.), Military Concepts and Philosophy, (Rutgers University Press, 1965), p. 21.

2. Michael Weisskopf, "Infantry Still Can't Kill Tanks," Washington Post, January 13, 1986, p. A1.

3. Frank E. Owens, Lt. Col., USA, (Ret.), "From Developer to User: Closing the Feedback Gap." Army. April 1983, p. 25.

4. Wm E. Depuy, General, USA (Ret.), "The Light Infantry: Indispensable Element of a Balanced Force." Army. June 1985, p. 39.

5. "The 'Unpleasantly Familiar Sound of Tom-Toms' Beclouds RDF Plans," Army, April 1980, p. 12. This editorial was headlined "Parochial Enthusiasms a Hinderance," and stated that "the Army and the Marine Corps are linked in some kind of intramural struggle over the leading ground combat role in the force being planned for contingencies outside Europe and Northeast Asia." [italics added]

6. Evan Thomas, "Drums Along the Potomac," reported by Bruxe van Voorst, Time, October 21, 1985, p. 35.

7. Tom Donnelly, "Army Will Replace 2 Anti-Tank Weapons," Army Times, September 30, 1985, pp. 37-38. In a related story, the Congress is cited for its interest in the Army's MANPRINT, "an Army program for integrating manpower, personnel and training consisderations into the design and fielding of weapon systems . . .." The story relates that the Army Vice Chief of Staff has addressed the MANPRINT snafus, and "persistent deficiencies with the Dragon anti-tank missile . . ." which at first appear to be ". . .problems with the design and training strategy of the Dragon system, [and for which Gen.] Thurman said the Army has had only marginal success in attempting to counter deficiencies of the weapon with special training programs and devices." Quoted from: Jim Tice, "MANPRINT Attracts Attention From Congress," Army Times, February 3, 1986, p. 46.

8. Wm E. Depuy, General, USA (Ret.), "The Light Infantry: Indispensable Element of a Balanced Force." Army. June 1985, p. 39.

9. On 23 September 1950, at the time of the Allies breakout from the Pusan Perimeter during the first months of the Korean War, a failure in air-ground C^3I occurred which resulted in approximately 60 friendly force casualties from an errant air strike with napalm. The combat battalion involved ws the Scottish Highlander "Argyll" Battalion, attached to the British 27th Infantry Brigade (U.S. 24th Infantry Division). While occupying Hill 282 and attacking across a saddle to the southwest toward Hill 388 "shortly before noon, with American artillery fire inexplicably withdrawn and the five supporting U.S. tanks unable to bring the enemy under fire because of terrain obstacles, the Argylls called for an air strike on enemy-held Hill 388." The problem of location reporting, navigating and identification of friendly forces is reflected in the folllowing detailed account:

> Just after noon the Argylls heard the sound of approaching planes. Three F-51 Mustangs circled Hill 282 where the British displayed their white recognition panels. The enemy on Hill 388 [employing imitative deception] also displayed white panels. To his dismay, Captain Radcliff of the tactical air control party [TACP] was unable to establish radio contact [Radioelectronic Combat, perhaps?] with the flight of F-51's. Suddenly, at 1215, the Mustangs attacked the wrong hill; they came in napalming and machinegunning the Argyll position. [Italics added]

Quoted from: Roy E. Appleman, South to the Naktong, North to the Yalu, (Washington, D.C.: Office of the Chief of Military History, Department of the Army, 1961), pp. 582-583.

10. Amos A. Jordan and William J. Taylor, Jr., American National Security Policy and Process (Baltimore: Johns Hopkins University Press, 1981), p. 59.

11. Ibid., pp. 59-60.

12. Ibid., p. 63.

13. Ibid., p. 65.

14. Kent Roberts Greenfield, American Strategy in World War II: A Reconsideration, (Westport: Greenwood Press, 1963), pp. 103-110.

15. Wm E. Depuy, General, USA (Ret.), "The Light Infantry: Indispensable Element of a Balanced Force." Army. June 1985, p. 41.

16. Amos A. Jordan and William J. Taylor, Jr., American National Security Policy and Process (Baltimore: Johns Hopkins University Press, 1981), p. 65.

17. Philip A. Karber, "The Strategy: In Defense of Forward Defense," Armed Forces Journal International, May 1984, p. 27.

18. Amos A. Jordan and William J. Taylor, Jr., American National Security Policy and Process (Baltimore: Johns Hopkins University Press, 1981), p. 67.

19. Philip A. Karber, "The Strategy: In Defense of Forward Defense," Armed Forces Journal International, May 1984, p. 27.

20. As previously described in the Introduction, SHF microwave provides line-of-sight radio linkage in support of the INTACS Corps 86 area communications "backbone" grid network. Whereas microwave usually emits a comparatively weak (less than one watt) signal, tropospheric-scatter systems greatly amplify this weak signal (1,000 watts or more) in order to increase the range of the radio link (by bouncing the SHF signal off the earth's tropospheric ion layer) from 50 miles to approximately 100 miles. The savings in isolated radio relay sites and support (including emergency reaction force) requirements logically supports the use of tropo systems. However, the higher operating power requirements make tropo systems more vulnerable to enemy Radioelectronic Combat.

21. Amos A. Jordan and William J. Taylor, Jr., American National Security Policy and Process (Baltimore: Johns Hopkins University Press, 1981), p. 70.

22. Ibid., p. 72.

23. Ibid., p. 73.

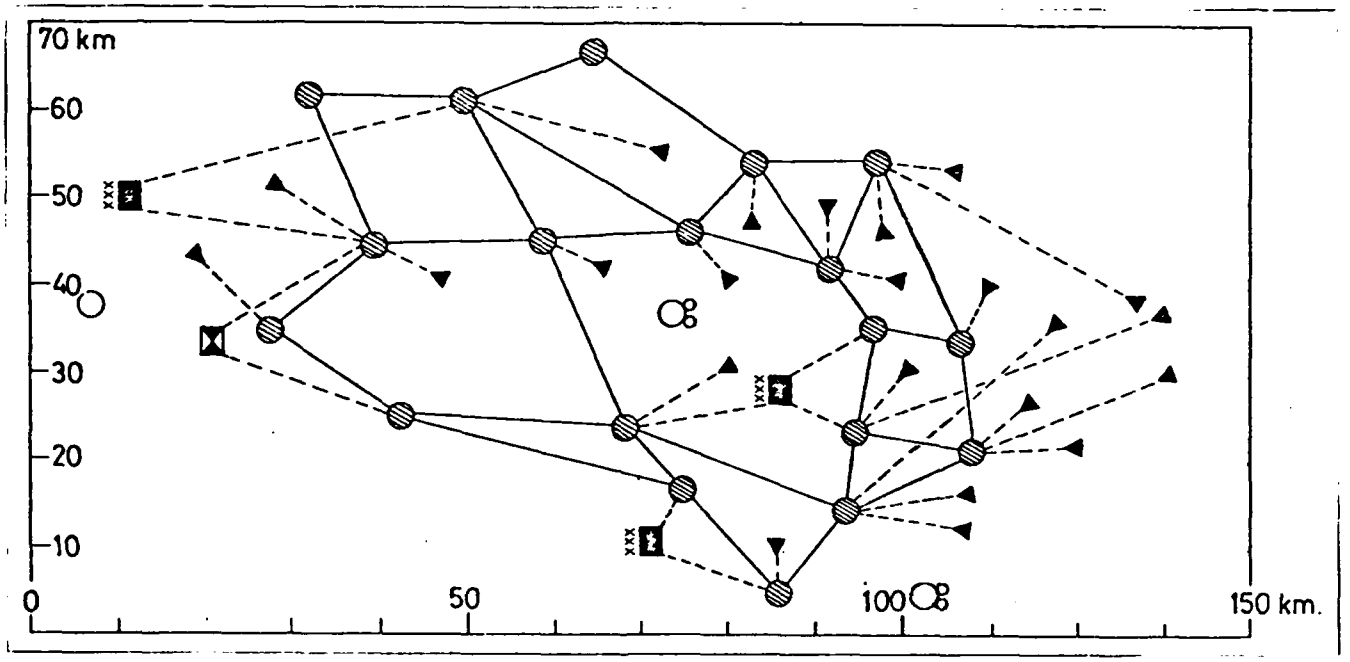
24. Allan R. Millett, The American Political System and Civilian Control of the Military: A Historical Perspective, (Columbus: Ohio State University, 1979), pp. 51-52.

25. Ibid.

26. Ibid., p. 52. The author states that "defense acquisition policies in the 1950's [were] often abetted by a Congress anxious to pump defense dollars into favored industries . . .." The term Military-Industrial Complex or MIC as it is sometimes referred to, is another factor in a technology-push versus demand-pull process (i.e., CBRS: Concept Based Requirement System). As quoted from a New York Times article: "Since President Eisenhower coined the term, in his farewell address in 1961, the influence of that complex has grown beyond his worst nightmares." As the author summarizes: "Military bureaucracy and 'the zeal of scientists in the weapons laboratories, as well as the economic motives of the aerospace industry, push toward ever more weapons . . . [and] spending as the way to create jobs." [italics added] Quoted from: Anthony Lewis, "The Military-Industrial Complex," New York Times,November 21, 1985, p. A35.

27. On 13 September 1983, at a Battlefield Communications Review at Fort Belvoir, ". . . the Vice Chief of Staff of the Army opened the meeting with some explicit guidance on the direction in which we [Signal Corps members] should be going. In summary, the Vice Chief stated that the goal for the communicator was to obtain a greater capability with less people and dollars and at the same time get [C^3I] assemblages smaller and more transportable." [italics added] Quoted from: Letter, ATZH-CG, US Army Signal Center and Fort Gordon, SUBJECT: Battlefield communications Review, dated 23 March 1984.

28. Maj. Gen. Jacques Deygout, "RITA: A Modern Response to Battlefield Communications Needs," Signal, March 1984, pp. 27-33. Maj. Gen. Deygout has been associated with the RITA technology for 20 years, having been involved in the RDA design, testing and evaluation of the system. As commanding general of the Rennes C-E school, he was involved with the user test and acceptance coincident with the fielding of RITA to the First French Corps. The diagram below is typical of a RITA Corps area communications "grid" network:



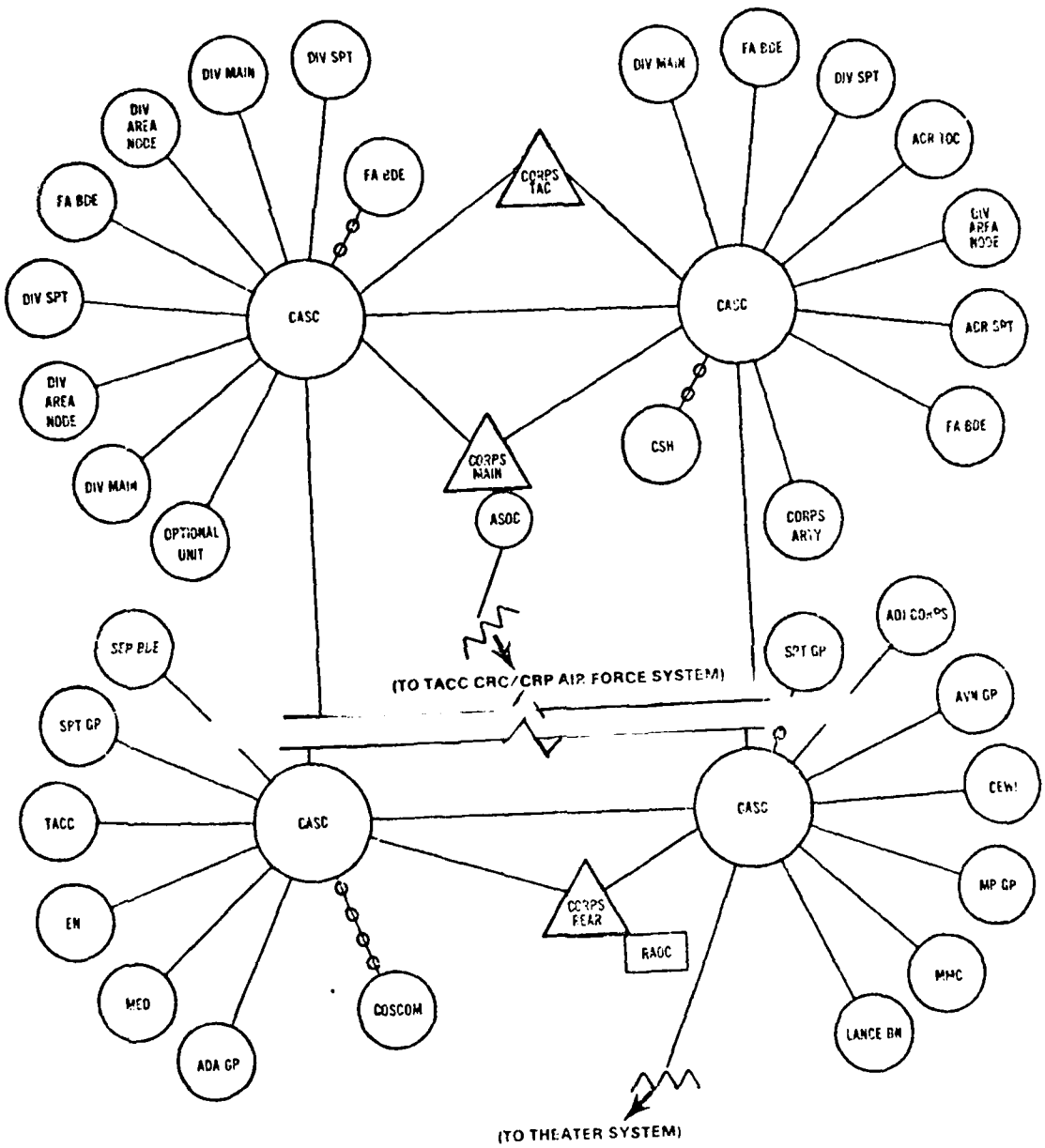
A tactical RITA deployment (June 24, 1983).

29. "Independent Evaluation of Digital Group Multiplexer (DGM) Asemblages and Field Exposed Components," IER-OT-693 (Falls Church: US Army Operational Test and Evaluation Agency, July 1981), p. i.

30. Martin Van Creveld, Command in War, (Cambridge: Harvard University Press, 1985), p. 238.

31. Ibid., p. 239.

32. The term: communications nodal site, refers to an area (vice command) multichannel communications network Forward Area Signal Center (FASC) in support of a combat division or separate brigade, or to a Corps Area Signal Center) in support of nondivisional units within a corps' (Field Forces') area of operations. At these locations (nodes) or within 10-15 kilometers wire/cable laying range, a customer can receive telephone, teletype, data, or facsimile communications support on a 24-hour basis. From these nodal sites, during Vietnam, were extended multichannel radio VHF (vice cable) systems to remote terminal locations (e.g., battalion/brigade firebases, advisor basecamps, major headquarters, etc.). Each node is established by an Area Signal Company (TOE 11-417), Corps Area Signal Battalion (TOE 11-415). The company is authorized: 165 EM; 6 Officers, and is equipped with 20 2 1/2-ton and 12 5/4-ton trucks. From Army Field Circular (FC 11-92), Combat Communications Within the Corps, (Fort Gordon: US Army Signal Center, January 1985), p. 2-5, is a four node (of 16 for a 5 division corps) configuration and the type of customers provided multichannel communications service. Note: the Air Support Operations Center (ASOC) tie in to the Air Component Headquarter's Tactical Air Control Center (TACC) and the Army's Battlefield coordination Center (BCE) as doctrinally established by the TRADOC Pam 525-45, Joint Attack of the Second Echelon (J-SAK) (Fort Monroe: US Army Training and Doctrine Command, 31 December 1984), pp. 6-1 to 6-3.


DIV MAIN
DIV SPT
DIV AREA NODE
FA BDE
DIV SPT
DIV AREA NODE
DIV MAIN
OPTIONAL UNIT
CASC
FA BDE
CORPS TAC
CORPS MAIN
ASOC
DIV MAIN
FA BDE
DIV SPT
ACR TOC
DIV AREA NODE
ACR SPT
FA BDE
CSH
CORPS ARTY
CASC
(TO TACC CRC/CRP AIR FORCE SYSTEM)
SEP BLE
SPT GP
TACC
EW
MED
ADA GP
COSCOM
CASC
CORPS REAR
RADC
SPT GP
ADJ CORPS
AVN GP
CEWI
MP GP
MHC
LANCE BN
CASC
(TO THEATER SYSTEM)

33. Creveld, p. 239.

34. Colonel Thomas A. Cardwell III, USAF, "Follow-On Forces Attack: Joint Interdiction by Another Name," Military Review, February 1986, p. 4.

35. Ibid., Colonel Cardwell believes that there is only a 'philosophical difference' between NATO's operational concept title FOFA and what the USAF Tactical Air Command and US Army Training and Doctrine Command (TRADOC) have jointly published as the TRADOC Pamphlet 525-series publication entitled: Joint Attack o the Second Echelon (J-SAK). The central issues involve the depth of the close-in and forward battle and use of Battlefield Air Interdiction (BAI) resources. Colonel Cardwell cites: General Bernard W. Rogers, "Follow-On Forces Attack (FOFA): Myths and Realities," NATO Review, December 1984, p. 1.

36. Keith A. Dunn and William O. Staudenmaier, Military Strategy in Transition: Defense and Deterrence in the 1980's, (Carlisle: US Army War College, July 1983), p. 1.

37. Russell F. Weigley, The American Way of War, (Bloomington: Indiana University Press, 1973), p. 464.

38. David R. Palmer, Summons of the Trumpet, (New York: Ballantine Books, 1978), p. 181.

39. Ibid., p. 184.

40. Jordan and Taylor, p. 75.

41. Many authors interchangeably use the terms: strategy, concept, doctrine, and principle. Definitions are in order. The definition of military strategy is particularly important as it shows the relationship between civilian established national policy and JCS military planning and operations. "The . . . one used [is] the one agreed upon by the US Joint Chiefs of Staff. 'The art and science of employing the armed forces of a nation to secure the objectives of naitonal policy by the application of force, or the threat of force'." Quoted from: Arthur F. Lykke, Jr., Colonel, USA. "A Methodology for Developing A Military Strategy." Military Strategy: Theory and Application. (Carlisle Barracks, PA: Department of National Security, US Army War College, May 1984), p. 1-7. For illustration purposes consider the National Security Policy of Containment as being interpreted and carried out as the Military Strategy: Flexible Response. This strategy can and has taken many forms (e.g., counterinsurgency forces, forces-in-being, navy surface fleets, etc.) and has been the genesis of innumerable concepts. The Forward Defense Concept for the deployment of NATO ground forces is one example. It has been the subject of numerous articles debating its merits in a geographical setting such as Western Europe. Doctrine, rather than being discussed in journal publications is found in authoritative manuals and regulations. "In contrast to a concept, . . . doctrine is

what is being taught, i.e., rules or procedures drawn by competent authority. Doctrines are precepts, guides to action, and suggested methods for solving problems or attaining desired results." This leads us to the question: Is the Active Defense and later, the AirLand Battle to be considered a concept or a doctrine? The answer lies in the amount of experience we have to generalize that a doctrine when applied will produce predictable results. IN WWII, the Blitzkrieg was a doctrine that yielded consistent results for the German Wehrmacht. No such evidence exists for the Active Defense or AirLand Battle, and therefore they remain as hypotheses, yet to be proven when the military force structure is available to test their merit. This leaves us the term: Principle, which can be described as a "self-evident truth." "Phrases as surprise, concentration, initiative, or economy of force epitomize the principles [of war] . . .. With doctrine, the thrust is on 'how to do it.' With principle, on the other hand, the thrust is to explain the underlying idea." Quotes from: I.B. Holley, Jr., Major General, USAF (Ret.). "Concepts, Doctrines, Principles: Are You Sure You Understand These Terms?" Air University Review, pp. 90-93.

42. Karber, p. 27.

43. Millett, p. 52.

44. Weigley, p. 75.

CHAPTER II

MISSION INTEGRATION: A CONCEPT OF BRINGING TOGETHER THE CAPABILITIES OF THE SEPARATE SERVICES

> Proposition 9: The United States must adopt a coalition strategy and posture. We simply cannot go it alone without allies. . . . Although NATO has created an unprecedented peacetime combined command structure, the forces at its disposal are all nationally configured and equipped.
>
> . . . . . .
>
> Proposition 11: Finally, we need a balanced joint military strategy. The fact is that the United States does not have even a unified strategy, much less a coalition one. Instead, we have four separate Service Strategies, loosely cobbled together by the JCS. . . .
>
> . . . The JCS simply add up all the Service wish lists and call this US force requirements. No wonder they complain about the 'mismatch between our strategy and resources.'
>
> . . . In an age of nuclear stalemate, when the United States is now second in overall military power, we can no longer afford to waste so much money or to make so many strategic mistakes.[1]
>
> Ambassador Robert W. Komer
> in Alternative Military
> Strategies For The Future.,
> Eds. (US Army War College)

INTRODUCTION

The introductory quote was taken from an Army War College precis covering a November 1983 conference sponsored by the Strategic Studies Institute. Analysts like Amb. Komer, Edward N. Luttwak, John Collins, and others have been bemoaning the fact that the Reagan administration buildup of defense forces "has been marred by appalling procurement practices and, even worse, that it has not been based on a coherent

vision of the nation's strategic needs,"[2] many years before Senators Barry Goldwater, Chairman of the Senate Armed Services Committee, and Sam Nunn published their study: Defense Organization: The Need for Change. In view of the fact that the President's FY 1987 Budget proposal to Congress will be scrutinized in the area of the military's authority to contract (i.e., total obligating authority: TOA) by the Gramm-Rudman-Hollings budget balancing law, there appear to be lean fiscal years ahead for the Services. For C^3I programs representing approximately 9.0 percent of the Army's TOA over the next 5 years, the message is clear, coalition and joint military strategy development had better justify the expenditures the Services seek. As we recall from the previous chapter, Project MALLARD was a candidate for termination due to the inability of the Army to provide the justification our civilian leadership in OSD and Congress seeks. As Senator Goldwater and Nunn were complaining at the end of 1985:

> . . . weapons 'programs determine strategy instead of strategy determining programs'. . . . In other words, even if it is conceded that the Reagan buildup has reversed the disastrous weakness of the 1970's, knowledgeable observers think the nation could have obtained more defense for the money. 'We have a Navy strategy, an Army strategy and an Air Force strategy,' [Congressional Analyst John] Collins says. 'But nobody in the office of the secretary of defense [OSD] or in the Joint Chiefs of Staff [JCS] is trying to put those pieces together. Over the last five years we have a national strategy called MORE--and a lot of money has gone down a lot of ratholes.'
>
> So the questions are, how much is enough--and how does the nation choose? The choices, terrible as they are, are unavoidable--even for a man with $2 trillion to spend.[3]

In current year dollars, the estimated total for tactical C^3I upgrades is: $13.4 billion. This price tag includes the following

programs: MSE: Mobile Subscriber Equipment--$5.0 billion; SINCGARS: Single Channel Ground and Airborne Radio Subsystem-VHF--$3.3 billion; Position Location Reporting System/Joint Tactical Information Distribution System Hybrid (PLRS/JTIDS)--$1.2 billion; Single Channel Objective Tactical [Satellite] Terminal SCOTT--$1.1 billion; and, TRI-TAC: Joint Tactical Communications--$2.8 billion. And, because each year the task of justifying constrained resources through the Planning, Programming, and Budgeting System (PPBS) becomes more arduous as these C^3I equipment items progress through their development cycle and are readied for force integration (fielding), it behooves us to determine the essence of the Congressional criticism leveled against the Services. The following four organizational deficiencies were extracted from the Senate report:

> o Operational failures and deficiencies - poor inter-Service coordination during the Vietnam conflict, the Iranian hostage rescue [DESERT ONE] mission, and even the intervention in Grenada [URGENT FURY] suggest deficiencies in the planning and preparation for employment of US military forces in times of crisis;
>
> o Acquisition process deficiencies - cost overruns, stretched-out development and delivery schedules, and unsatisfactory weapons performance have been frequent criticisms of the acquisition process;
>
> o Lack of strategic direction - the strategies and long-range policies of the Department of Defense do not appear to be well formulated and are apparently only loosely connected to subsequent resource allocations; and,
>
> o Poor inter-Service coordination - the programs of the individual military Services do <u>not appear to be well integrated around a common purpose that clearly ties means to goals</u>.[4] [Italics, added]

Concept or Doctrine?

Probably an equally apt quote to capture the essence of this Chapter would have been this one from B. H. Liddell Hart: "The only thing harder than getting a new idea into the military mind is to get an old one out." And, so it was when in the later 1960's and early 1970's communications-electronics planners set out to establish the tactical communications architecture for the Army of the 1990's, they relied on our C^3I experience from Southeast Asia (SEA) to guide their efforts. The result was a Department of the Army (DA) approved document titled: the Integrated Tactical Communications Study (INTACS), published in 1976. It was the major driving force behind the TRI-TAC Program, although by 1976 many of the RDA efforts were well underway, if not already under contract. But, for the SEA experience with its global C-E radio and cable links and telephone dial central office (DCO) capability down to combat brigade basecamp level, what other strategic model or operational concept did the folks at the US Army Signal Center, Fort Gordon, Georgia, have to guide their analyses? Very little, in fact. For example, Field Manual 100-15: Corps Operations has over the past 10 years been distributed as FM 100-15 (TEST): Larger Unit Operations, as a Coordinating Draft with the disclaimer that it is "for instructional purposes only and does not represent approved DA doctrine,"[5] and most recently as a Field Circular (FC) in 1984 which forecasts the publication of the field manual "incorporating [a] final decision on current studies on the force structure of the corps and on procedures for Joint Attack of the Second Echelon (J-SAK)."[6] Is it any wonder then with this example of softness in "How To Fight" doctrine, why the

drafters of Field Manual 11-92: Combat Communications Within The Corps[7] don't make reference to FM 100-15? Or, why our NATO Allies, with whom we have only begun to establish a working C^3I (interoperability) relationship, have forged ahead independently with the strategy of Flexible Response and developed the Follow-On Force Attack (FOFA) as a subconcept.

These are classic examples of the "right hand not knowing what the left hand is doing" both at the coalition and the joint military operational concept development levels. And, unless it escaped your notice, a new doctrinal term has been added to muddy the waters still further. The term is: J-SAK. Whatever happened to AirLand Battle (AL.. doctrine? If you ask any Air Force officer, he'll tell you that ALB was never signed up to by the USAF. If one checks the operating procedures for J-SAK,[8] no word is mentioned of either FM 100-15 or FM 11-92 as complementary doctrinal publications.

In spite of the fact that Field Manual 100-5: Operations has undergone two major revisions (i.e., 1976 and 1982) and is soon to be republished in 1986, no soldier should have to ask the question: Is ALB an operational concept or is it doctrine? In the previous chapter we examined the difference between the two terms (i.e., concept, doctrine); both of which by degree of recorded lessons-learned[9] (as derived from realistic training, live-fire scenarios, or field trial testing) illuminate how military strategy (i.e., Flexible Response) and national security policy (i.e., Containment) will be executed jointly by the Services and in coalition with our Allies. From a definitional standpoint, a strong case can be made for the fact that ALB doctrine hasn't been tested sufficiently with its modernized force structure

(e.g., sensor, target acquisition, and multiple rocket launcher systems) to be considered a "tried and true" methodology. Nor has it been systematically analyzed and/or is it a derivation "by generalization through study of recorded accumulated experience."[10] But, how long can we wait until all the results are in to finally label ALB a bonafide doctrine? If the Congressional criticism, Gramm-Rudman law, and lack of "jointness" with the other Services are any indication, we don't have the luxury of time for a full analysis. Therefore, for the remainder of this paper, the assumption must be that ALB is the current operational doctrine for fighting the air-land battle within all five of the Army's Corps. This includes the contingency corps, which "must be prepared to conduct operations anywhere in the world."[11]

Recognizing the Need for Change

When does a concept become recognized as doctrine? And, how does an army establish doctrine, when, as an institution, it is subject to continuous change through force structure reorganization (e.g., Army of Excellence) and force integration with new technology? To answer these two hypothetical questions, an historic example is in order. Prior to the outbreak of World War II, the German Army was faced with the task of effecting change to its operational concept of warfare. Within the short span of 18 months this change was effected. General Heinze Guderian was the major architect behind the change that saw the birth of the blitzkreig doctrine which was the result of repeated field demonstrations by the Wehrmacht and Luftwaffe. Interestingly, these field trials were prompted by the study of the writings of such British visionaries as J. F. C. Fuller and B. H. Liddell Hart and the record of the trials on the Salisbury Plain.[12] Whereas the German's seized the

initiative and innovatively applied the lessons-learned from their field trials, the US and its Allies were not as responsive to change, so that:

> As war came to Europe in 1939, the British Army found itself with an imperfectly developed concept [vice doctrine] of all-arms combat based on the tank, to include inadequate tactics, organizations, equipment and training to implement a state of warfare they themselves had invented.
>
> In the US Army, the pioneers were fewer in number, and the institution proved considerably more resistant to change than even the British Army. Therefore, the development of a concept of mobile warfare fared even less well.[13]

What magic did General Guderian work with the German Army so that in a very short time it institutionalized the operational concepts for "mobile all-arms warfare built around the tank striking force?"[14] Contrast this flexibility to accept change with the tardiness displayed by the US Forces in organizing and training the air-tank teams which eventually proved successful in the breakout from Normandy in the Summer of 1944. Contrast the German Army's acceptance of the operational art of warfare with the sad condition of US Forces at the outbreak of hostilities in Korea. The former Commanding General, Training and Doctrine Command, General Donn A. Starry, in an address to the US Army War College in June 1982, cited several authors like Kenneth Macksey, Timothy Lupfer and Albert Seaton who have conducted indepth study of the German process for educating their officer cadre, cultivating creativity, and effecting reform "for changing doctrine-strategy, operational art, tactics, describing the equipment, organizational training and other changes needed" in order to respond to shifting requirements and the current state of technology.[15] As a change agent of sorts for the reform of the US Army, General Starry was the driving force behind the development and publication of a "series of TRADOC

Pamphlets [525-series] used to disseminate operational concepts."[16] The TRADOC Pamphlet 525-5: The AirLand Battle and Corps 86 provides the combat, combat support, and combat service support branches with the guidance for conducting operations under the "umbrella concept" of AirLand Battle. The pamphlets were designed to effect change and:

> . . . set forth functions and tasks to be accomplished by the various levels of command during combat. They are to be used by Army training, organization, doctrine, and materiel developers to develop their various programs. They may also be used by the operating forces of the Army in the conduct of training and other preparations for combat operations, pending incorporation of the concept into doctrinal and training literature.[17] [italics, mine]

A Climate for Change

It follows then, that the message for the combat support and service support arms is: accept the dynamics of change as a constant; keep current on the frequently changing requirements of the combat arms; understand the research, development and acquisition (RDA) process and how to make it work; and, make a positive contribution to making doctrinal changes work at your level. The remainder of this Chapter will be devoted to examining some of the antecedents of the doctrinal change in the 1982 version of Field Manual 100-5: Operations and to determine what impact it has for employing C^3I systems in a support role. The charter for doing this has been established by the Army Chief of Staff, General John Wickham. In a recent interview he was asked: "What have you done to change the climate in the Army so that a bold, creative officer could survive?"[18] He replied:

> Being responsive to orders, carrying them out to the fullest extent, being filled with integrity and commitment, I think, are characteristics that are

> associated with bold and creative leadership, and we have tried to encourage that in the Army.
>
> General [Harold K.] Johnson, when he was Chief of Staff of the Army, had a little wooden turtle on the desk, and as people would come in, he was quick to say, 'Look at the turtle there. The turtle gets ahead only when he sticks his neck out, but he also moves very slowly. Change comes slowly. But one needs to take risks, one needs to be bold and creative.' That was what he was emphasizing with that little symbolism. I think that all young people--all people, for that matter are--anxious for opportunities to grow, to fulfill themselves, to be all they can be.[19] [Italics added]

Advocacy for Change

Casting oneself in the role of an advocate for change (change agent) can be a risky and frustrating business. The level of frustration is reflected in military journal articles which omit the author's name or substitute instead a pseudonym (i.e., General Damon)[20] for the real identity of the erstwhile reformer. But, he or she shouldn't be surprised by the reluctance of the military and civilian hierarchy to accept change. It wasn't too many years ago that the systems analysts in the government had everyone convinced that all uncertainty could be dispelled through the "scientific method" and that the problems of the world could be quantified and modelled for "fool-proof" decisionmaking. We are smarter today, but old habits have a way of hanging around. Why? Because they're as comfortable as that old pair of bedroom slippers you continually put on every night when you know that someday you'll have to eventually please your wife and begin to wear the brand new ones she bought for you two Christmases ago. The human behavioral scientists have a term for this type of overt behavior. It is called: Cognitive Dissonance, and has been used in "the study of

motivation and behavior [in] a search for answers to perplexing questions about the nature of man."[21] Behavioral scientist Leon Festinger has theorized that:

> Dissonance is created when two perceptions that are relevant to each other are in conflict. This creates tension which is psychologically uncomfortable and causes the individual to try to modify one of the incompatible knowledges so as to reduce the tension or dissonance. . . . For example, Festinger has done research that shows that 'heavy smokers are less likely to believe that there is a relationship between smoking and lung cancer than non-smokers.' In other words, if one cannot give up smoking, he can at least remain skeptical about research that reports harmful effects. The same phenomenon is at work when a person goes out, fishes all day, doesn't catch anything, and remarks about the beautiful weather.[22]

Shift in Doctrine (1976 to 1985)

A December 1985 article by R. J. Raggett, Editor of Jane's Military Communications in Signal magazine contrasts the differing command and control (C^2) philosophies of the Warsaw Pact and NATO Allies. In tune with Field Manual 100-5: Operations and General Bernard W. Rogers, Supreme Allied Commander, Europe, who has expressed concern "that the brittleness of NATO's defenses could result in early alliance recourse to nuclear weapons."[23] Mr. Raggett details how the

> West has moved increasingly toward [C^2] decentralization in which command decisions are based on a wide range of inputs provided from all levels of the military hierarchy . . . [and for this reason] is infinitely more dependent on effective C^3I than is the Soviet Union.[24]

To be sure, the AirLand Battle doctrine addresses the "increased tempo, lethality, and mobility"[25] of the modern battlefield and establishes four principles (i.e., Initiative, Depth, Agility, and Synchronization) while emphasizing that "the human element: courageous, well-trained

soldier and skillful, effective leaders" are the keys to survival and success. The 1982 version of Field Manual 100-5: Operations also cites "rapid decision-making" as a key to success. This same theme is further expounded upon by Field Manual 101-5: Staff Organization and Operations when it states "the commander who continues to exercise effective command and control [C^2] will enjoy a decisive edge over his opponent."[26] The manual goes on to describe what constitutes an effective tactical operations center (TOC) which includes:

> . . . supporting automation and communications systems . . . [to] provide processing and transmission of information and orders necessary for effective command and control.
>
> The unique character of command and control of military operations is that it must be effective under the extraordinary stress of battle--in obscure situations, in compressed time, and under psychological and materiel losses. Also, unique to military operations is the need for the command and control system to work quickly. It must be designed with such efficiency and dispatch that the decision-making process works faster and better than that of the enemy.[27]

Technology Transfer

We will return to the description of the C^2 process in FM 101-5, later, but now we need to focus on technology available to support the automation, and communications, and decisionmaking process. It is beyond the scope of this paper to explore the human element in decisionmaking, or to answer the question of why it is a must to focus on the commander in the conceptual design of battlefield automation systems. For now we will concentrate on the technological [vice behavioral] aspects of decision support systems (DSS). And, begin by understanding what Mr. Raggett means when he says:

> . . . the West should not get too hysterical about high technology leakages, but should concentrate on maintaining and more effectively using the technology lead it has. Current US attitudes are frustrating the normal free flow of technology between the NATO allies and, in the long term, this will only serve to weaken the Alliance's overall C^3I capability.[28]

ANNEX A (TECHNOLOGY TRANSFER: An Economic Challenge to National Security) addresses the prevailing argument over the risk of sharing technology versus the risk of falling behind the Soviets in C^3I and C^2. Suffice for us to realize that this question of technology transfer will always be ongoing and never quite satisfy all parties. A parallel to this dilemma is in the design of C^2 systems themselves. For as doctrine and operational art techniques evolve, so will:

> . . . the efficiency of the command and control system [be] measured by the extent to which the commander's intentions are carried out and the ability to cope quickly and effectively with changes in the situation. The command and control system is evolving continuously. It must develop according to the demands of new weapons, communications [C^3I], tactics, terms of reference, and the number, type, and structure of units likely to be subordinated to the organization.[29]

Concept Development

We could at this juncture explore the fascinating worlds of emerging C^3I and C^2 technology. The military and civilian journals are filled with articles and advertisements that will dazzle the imagination of even the most casual observer. And, if hardware vendor visits to Headquarters, TRADOC are any indication of the pressure brought to bear on the concept development community to seek this new technology, to expand a requirement document (Army Regulation 71-9: Materiel Objectives and Requirements) to include this "gee-whiz" bell or

whistle feature, or whatever the "ole boy" network of the military-industrial complex (MIC)[30] can do to influence the RDA process for selfless or selfish motives, the bottom-line remains the same. The US Forces are driven more by technology than by conceptual advocacy. It stands to reason that the slick, multi-colored advertisement brochures of the MIC are infinitely more appealing than the dull, black-and-white dogma of the TRADOC 525-series pamphlets. And, whereas the MIC makes certain that the reader is not forced to incur the "psychological discomfort" of having to cast away old ways of thinking about tactics, leadership, and such things as that, a TRADOC Pamphlet 525-5: Operational Concepts For The AirLand Battle and Corps Operations-1986, will cause at least a mild case of cognitive dissonance to the most fervent risk-taker and warrior leader.

And, why wouldn't doctrine change cause intrepidation. Beginning in 1976 with the issuance of the Active Defense version of FM 100-5, to the most recent publications of Army, Military Review, Armed Forces Journal International, Air University Review, and other such forums for professional discourse and criticism, there has been a steady drum-beat of controversy over doctrinal issues. As Major General Edward B. Atkeson surmises:

> First, those involved should not be overly alarmed at criticism. Properly received, criticism can be healthy and conducive to timely change when change would bring improvement. . . .
>
> Second, the United States should stick with its basic strategy of scaled, flexible response. . . .
>
> Third, the notion of adding depth to the battlefield appears basically sound for development at both the operational (theater) and tactical levels. . . .
>
> But, this country has insufficient experience in integrating [division or corps] forces with other

> national and international formations. Elaborate systems for transmitting vital tactical intelligence to US units fighting in a US corps exist, but US planners tend to overlook the likelihood that if war occurred, as many as half of the US divisions and brigades might of necessity be pressed into service as part of Belgian, Dutch, and West German corps. Cross-assignment of national forces might prove to be more the rule than the exception.[31] [Italics added]

The next sub-chapter will deal with lessons-learned when concept development and the advocacy for change processes become muddled by parochialism and bureaucratic stagnation. But, before we address specifics, we need to address the relationship between doctrine and principles. An example of a fundamental practice (or axiom, tenet, rule, etc.) in C^3I is that in the absence of any directive to the contrary, C-E cable/radio systems are established as follows: 1) From the unit on the left to the unit on the right; 2) From the higher unit to the lower; and, 3) From the supporting unit (e.g., artillery or surveillance radar element) to the supported unit. In coalition and joint Service operations, the more aspects of a mission which can be reduced to principles and standing operating procedure (SOP), the less likely will be the chance for error. ANNEX B (C^3I FUNDAMENTALS: Principles for Survival and Success On The Battlefield) is a partial list of tactical communications fundamentals as observed by two general officers. The importance of these principles is illustrated in the WW II Normandy Landing plans of 1944. The following excerpt was taken from the "Neptune" initial joint signal plan on lateral communications:

> Except when they are clearly defined to the contrary, responsibilities are as follows: Between adjacent headquarters of different nations, when of equal rank, it is the responsibility of the formation on the right to initiate communication to

> the corresponding formation on the left. When a lateral link is required between headquarters of one nation and headquarters of a lower rank of another nation the responsibility rests on the higher formation. . . . When lateral communication across an inter-allied boundary is required at two or more levels the responsibility will be alternately British and US, . . . In principle any channel will be operated throughout by personnel of the same nationality and/or Service.[32] [Italics added]

A Lesson-Learned: C^3I Interoperability

From ANNEX A we learned that RSI (Rationalization, Standardization, and Interoperability) is formal materiel development program (AR 43-1) which is focused on increasing the operational effectiveness of alliances such as NATO. A definition of interoperability follows:

> Capability of two or more items or components of equipment to perform essentially the same function or to complement each other in a system, regardless of differences in technical characteristics and with negligible additional training of personnel.[33]

Interoperability is as fundamental to the RDA process as the Army's current "umbrella" concept (AirLand Battle) is at the core of its doctrine. Both can have as profound an impact on the success of a REFORGER (Return of Forces to Germany) contingency to reinforce the (NATO) Central Army Group, Central Europe (CENTAG) as the basic tenets of AirLand Battle doctrine: initiative, depth, agility, and synchronization.[34] Materiel development and trade journals are continuously addressing RSI, a direct reflection of the fact that

> the Joint Chiefs of Staff and the NATO military committee have established five standardization/ interoperability priority areas: command, control, and communications [C^3I]; cross-servicing of aircraft; interchangeable acquisition; and standardization/interoperability of components and spare parts.[35]

Along with ILS (Integrated Logistic Support: AR 700-127) and P^3I (Preplanned Produce Improvement: AR 70-15), and because of its involvement with technology transfer and the protection of Allied combat force multipliers, RSI has been at the forefront of OSD's attempt to improve materiel acquisition strategy.[36] ILS and P^3I will be covered in greater detail in Chapter III.

Suffice for now in our study of the concept (vice materiel) development business, that by the early 1980's:

> related to RSI are the international military standardization agreements (STANAG). Both NATO and Central Treaty Organization (CENTO) nations have agreed to insure the highest possible degree of interoperability among the military services of signatory nations. From a logistics standpoint, these STANAG's (if implemented) standardize fuel, ammunition, much of our support equipment and procedures, tactics, and doctrine. In addition, [AMC: Army Materiel Command] has the responsibility for managing the Army's International Material Evaluation (IME) Program. Upon receipt of a materiel requirements document [i.e., AR 71-9], the US Army Test and Evaluation Command (TECOM) will conduct an investigation to determine if there is a foreign system available which is potentially capable of satisfying the Army's requirement.[37]

You will recall what General Atkeson said earlier: "this country has insufficient experience in integrating forces with other national and international formations."[38] The November and December 1985 issues of Signal magazine echo the same sentiment as each issue delves in depth with NATO and Soviet C^3I systems. The list of contributing authors reads like a "who's who" from the military and commercial C^2 and C^3I worlds. On page 21 of the November issue, there appears a multi-colored diagram of what has become known as "the SIGMA-Star." This particular diagram is from a MAGNOVOX, Electric Systems Company, advertisement for its contributions to the Advanced Field Artillery

Tactical Data System (AFATDS) which is according to the contractor is a "database-driven, display intensive command/control [system]" which when tied into a "distributed data processing and tactical communications" network gives us the five points of the star.[39] Each of the five points in turn represent: Maneuver Control; Air Defense Control; Fire Support Control (e.g., AFATDS, Firefinder, TACFIRE, etc.); Intelligence/Electronic Warfare (I/EW); and Combat Service Support (CSS). The following is an example which illustrates the control and interoperability problem as told to us by a combat arms officer:

> Enemy troops can be seen advancing to the tree line. The forward observer (FO) determines the azimuth and range and requests a fire mission. His battalion computes the firing coordinates and passes them to the guns.
>
> In seconds, rounds are on the way to impact on the spot illuminated by his laser designator [e.g., AN/TVQ-2: Ground Laser Locator-Designator: GLLD]. . . . What is important about this scenario is that not a word needs to be spoken. Information systems that exist today could support each of the players in getting the job done. The FO could use a hand-held device [digital message entry device: DMED] to enter the azimuth and range of the target. This information, coupled with his position on the ground as reported by position locating and reporting system [PLRS/Joint Tactical Information Distribution System as part of the Army data dist. system: ADDS][40] [or] could be transmitted via a combat net radio [e.g., AN/VRC-12 series or SINCGARS: Single-channel Ground and Airborne Radio System] to a computer at battalion for computing firing coordinates [i.e., AFATDS] to pass to the guns.
>
> After impact of the rounds, the FO could use the same [DMED] to report the results of the engagement to commanders and their intelligence and operations officers in tactical operations centers (TOC's). Additionally, the computer system in the firing battery could report the number of rounds expended to the resupply point and receive information

> concerning maintenance that might be required as a result of this fire mission.
> . . . . . .
> the rounds of artillery expended, which appears to be tactical [or operational level] information at first glance, becomes command and control information when it updates 'ammunition status' in the division [or corps/army/theater] TOC, changes to sustaining base [e.g., CONUS] information when it triggers a request for resupply from a continental US ammunition depot, and may even become strategic information when it is rolled up as part of 'ground force logistics status' for the Joint Chiefs of Staff.[41]

This illustration not only shows the relationship between the five-points of SIGMA-Star, but the C^3I transmission media involved in getting the message from one end of the battlefield to another, as well as defining the difference between the data bases: tactical, sustaining base, and strategic. Organized under the newly created Office of the Assistant Chief of Staff for Information Management (OACSIM), the Department of Army (DA) the OSD element (Joint Tactical C^3 Agency: JTC^3A) and the JCS C^3 Systems Directorate are trying to get a handle on the interoperability and battlefield coordination problem. As LTG C. E. McKnight, Jr., Director for C^3 Systems, JCS puts it, "interoperability is not a new challenge. It has been around since before the Tower of Babel."[42] But, regardless of the Pentagon initiatives, reorganizations, and "attempts to revise the US Department of Defense (DOD) Directive on interoperability (4630.5) [which have] been 'frustrated by Pentagon bureaucracy',"[43] the fact remains:

> A problem exists. . . . Since the majority of the information systems mentioned [above] have been developed independently, they do not automatically 'talk' to each other. As a result, the user must either pass information verbally or by using paper, magnetic tape or punched cards, or he must buy equipment [referred to as 'black box' add-ons which increase the complexity and decrease the reliability of the system] that translates the information so

> that the various information systems understand each other.[44]

This, in thumbnail form, is the heart of the C^3I interoperability problem. And if we are to learn anything from it so that we don't make the same mistakes with future materiel acquisition programs, we must keep in mind that the seeds of management information integration begin with the concept people [combat development] who draft the early requirement documents. Both in the Letter of Agreement (LOA) which takes the C^3I system development through Concept Exploration and Force-Development Testing and Experimentation (FDTE: Army Regulation 70-10), and the Required Operational Capability (ROC) document which takes the program through Milestone III decision cycle on production/deployment, interoperability must be given the highest status as a critical issue. By definition:

> Critical issues are those issues associated with the development of an item/system that are of primary importance to the decision authority in reaching a decision to allow the item/system to continue into the next phase of acquisition [and eventually be issued to the soldier].[45]

It is not this writer's intent to examine the various reasons why C^3I interoperability has been such a problem since the building of the Tower of Babel. Only to say that the Theory of Cognitive Dissonance postulated by Leon Festinger and parochialism are major factors in the equation. What needs to be examined is the impact of interoperability on the three C^3I transmission media which make up the SIGMA-Star architecture (AC^2MP: Army Command/Control Master Plan) and provides the "glue" for holding it together. These three systems are: 1) Joint Tactical Communications (TRI-TAC) program, which includes the Mobile

Subscriber Equipment (MSE) program described in ANNEX A; 2) Army Data Distribution System (ADDS), a digital communications system which will draw upon the technologies of the Position Location Reporting System (PLRS) which is scheduled for initial fielding in 1986, and the Joint Tactical Information System (JTIDS); 3) Combat Net Radio (CNR) system which calls for the replacement of the AN/VRC-12 series with the Single-Channel and Airborne Radio System (SINCGARS) beginning in FY 1986. "This program will provide secure, jam-resistant, very high frequency (VHF) radios to replace the 20-year-old equipment now in use with combat battalions and companies."[46]

The Integrated Tactical Communications System (INTACS) Study

Beginning in the early 1960's with frequency division multiplexing of analog signals, the Integrated Tactical Communications System (INTACS) study sponsored by the US Army Signal Center, Fort Gordon, GA, in 1976 provided a conceptual framework for transition to pure digital communications transmission. By its very nature, digital transmission of telephone, teletype and facsimile circuits would result in radio and wire (cable) links with upwards of a sixfold increase in information carrying capacity.

We have to remind ourselves that the INTACS study was drafted in the shadow of the US Army Signal Corps' Vietnam experience and the cost consciousness of the Office of the Secretary of Defense (OSD). What the latter factor resulted in was the Army's adoption of ongoing C^3I materiel development programs initiated by the Air Force. Directed by a Joint Chiefs of Staff memoranda in the 1973-74 timeframe, and guided by Department of the Air Force Required Operational Capability (ROC) documentation, the Army was drawn into a joint developmental effort

which became known as the Joint Tactical Communications (TRI-TAC) Program. No one either in the concept or materiel development community raised any alarm that what constituted satisfactory C^3I equipment modems, shelterized assemblages, and user terminals for the command and control needs of the Tactical Air Forces are not necessarily adaptable to Land Forces. Even before the publication of the Active Defense and AirLand Battle doctrines, the TRI-TAC equipment architecture could never be construed to support overland, mobile maneuver elements which required frequent changes in the communications network and telephone/teletype directory system. In contrast, the support of USAF command and control elements require relatively "fixed" communications nodal sites which are positioned on or adjacent to hard-surfaced airfield runways and service subscribers who are consistently serviced off the same message (teletype) or circuit (telephone) switchboard. In the early 1970's no one foresaw that the publication and distribution of directories, although not an arduous task for the USAF, was a monumental mission for the Army, and one that could never be successfully accomplished in combat. In addition, although it could not be projected at that time, what constitutes satisfactory accomplishment of airman operator and maintainer job-tasks, does not necessarily equate to successful accomplishment within the Military Occupational Specialty (MOS) categories of the Army. This refers to the Operational and Organizational Plan (O&O) describing how the materiel development will be integrated into the force structure insures that "personnel impacts are determined based on an examination of the system design and an assessment of the personnel skills needed to operate and maintain the system."[47] The areas of Qualitative and Quantitative Personnel

Requirements Information (QQPRI) and the Logistics Support Analysis (LSA) will be covered in Chapter III from a materiel development standpoint.

The combat developer is responsible for the development of the O&O Plan as part of the Mission Area Analysis (MAA) process. In the case of INTACS, the MAA process was not followed. In fact, although initiated in 1976, it was not published until June 1979, long after the awarding of the majority of the major TRI-TAC contracts to industry. Therefore, (even if they had wanted to) the TRADOC and Signal Center communities had very little "leverage" to bring to bear on the TRI-TAC RDA process. And, there is very little indication that they did want to, for to question the validity of an ongoing materiel development and seek "the truth" requires the utmost in risk-taking and thwarting of the cognitive dissonance, defense mechanism.

But, before we become to much the "Monday morning quarterback," we must remember that the lure of increased information-carrying capacity (up from 96 analog channels to 576 digital channels at a binary digit rate of 18.72 Mb/s) was a powerful incentive. And, after all, didn't the program follow the carefully laid out dictates of the JCS and OSD? Only within the last 2 years, as indicated by the rising star of the Mobile Subscriber Equipment (MSE) concept, (which incidently is technology well in hand as shown by the proliferation of "cellular-radio" automobile telephone companies), has anyone within the RDA decisionmaking hierarchy questioned the suitability of TRI-TAC for Land Forces employment. By delaying a robust search for new technologies, the Vietnam-era has exacted a heavy toll in the development of tactical communications and particularly in the battlefield automation mission

area. In his book, Command in War, Martin Van Creveld sums up the "blindness" which has permeated the military:

> During the two decades after 1945, several factors came together and caused the American armed forces to undergo an unprecedented process of centralization. In the first place, there was the revolutionary explosion of electronic communications and automatic data processing equipment, which made effective worldwide command and control from Washington a practical technological proposition . . . [and] within eighteen months of entering office as Secretary of Defense, Robert McNamara had put into operation the . . . Defense Communications Agency (DCA) . . . [and] the Office of Defense Research and Engineering (ODRE) was expanded and assigned the task of supervising all Pentagon-sponsored research programs.
>
> . . . . . .
>
> [Meanwhile in Vietnam, as noted earlier, there] was the proliferation of sole user circuits ['hot lines'] at every level, a typical divisional operations rooms containing no fewer than thirty-five such lines. . . . A second indication that, during the war in Vietnam, a gap opened between the demand for information and the ability of the communications system to transmit it may be found in the distribution of [teletype] messages among the various categories of precedence . . . the proportion of traffic classified as either 'Immediate' or 'Flash' sometimes exceeded one-half of the total, creating bottlenecks, indicating that messages placed in the lowest categories were regarded by the troops as standing scant chance of getting through on time, if at all, and incidentally compelling the Joint Chiefs of Staff to institute a new 'Superflash' category so as to ensure that their own messages would in fact go through. . . .[48]

Joint Tactical Communications (TRI-TAC) Program

The total TRI-TAC Program involves the acquisition of numerous telephones, radio-telephones (e.g., NRI: Net Radio Interface, and MSE), circuit and message switches, in addition to radio and cable transmission equipment. But it was the radio/cable components and shelter assemblages, collectively called the Digital Group Multiplexer

(DGM) family, which came in for the closest scrutiny during Development Test II and the Initial Operational Test (IOT) conducted by Army personnel at Fort Huachuca, AZ, from 2 September to 7 November 1980 (10 weeks). This scrutiny was justified by the fact that the INTACS study called for the transition period to take place in four phases and placed heavy emphasis on interoperability among: 1) the current inventory of Army Tactical Communications Systems (ATACS); 2) Improved ATACS (IATACS) which consisted of "black box" add-ons to increase the information-carrying capacity of current time division multiplex (TDM) equipment; 3) hybrid mixes of two or more communications technologies, and; 4) finally, pure (TRI-TAC) equipment items. In the meantime, the Reserve Components would still be showing up on the battlefield with a mixed bag of equipment, all of which would require the utmost skill of Technical Controller (MOS 31N) personnel to interconnect and insure acceptable communications service to subscribers. The Independent Evaluation Report (IER) prepared in accordance with Army Regulation 7-3: User Testing lists seven separate requirement documents in which the concept people tried to articulate their need for meeting the increasing demand to provide intelligence and target acquisition information on a near real time basis. Eschewing the first three phases of the RDA Life Cycle System Management Model (LCSMM), the DGM Program was plunged headlong into Full-Scale Development with the fervent hope that Raytheon Corp. in Sudbury, Mass., would somehow subdue the issues of interoperability, man/machine interface, and meeting the basic tenets of the AirLand Battle doctrine.

The lack of conceptualization (i.e., mission area analysis) preceding the TRI-TAC Program eventually gave rise to the Subscriber

Equipment (MSE) concept developed largely by our NATO Allies. Speaking at the first Joint Tactical C^3 Agency (JTC^3A) conference, LTG Doyle, ACSIM, appears to have had the C^3I deficiencies of Vietnam in mind when he said:

> We fully expect to fight alongside the armies of other nations, be provided close air support by the Air Forces of different nations and conduct amphibious operations with Naval and Marine Forces in many multi-national configurations . . . it is important that we understand that interoperability is not an objective by itself. Interoperability is one means of providing our commanders an effective command and control [system] on the battlefields. Modern warfare dictates that the static configurations we use to depict the way our forces will deploy and fight on the battlefield will hold true for only short periods of time. Our commanders will be faced with continuously changing configurations and must have supporting C^3 systems that accommodates these requirements.
>
> A commander should not have to ask himself, as he fights the battle, if he is located at the right place in the communications network. The network must be designed to allow him to connect into it as he chooses.
>
> . . . . . .
>
> Our first step in tackling the problem is to get the operational interface requirements defined, consolidated and brought under control. We cannot expect to get the C^3 system right if the user cannot define what he wants.[49] [Italics, added]

Even before the publication of the 1982 version of Field Manual 100-5: Operations there was a growing awareness of the pace and vast distances imposed by the Soviet threat. Beginning with "as little as 48 hours warning," one author has guessed that "the time-space factors for engaging each [Warsaw Pact] army can be estimated by assuming sustained advances of 30 to 50 kilometers per day; an entire front can be engaged within 9 days."[50] Writing in Signal magazine in the Fall of 1981, LTG Donald R. Keith, Deputy Chief of Staff for Research, Development and

Acquisition (DCSRDA), Department of the Army, had the vision of a change agent when he proposed:

> The battlefield of the future will be one of incredible lethality. To defeat a numerically superior force, the commander must be able to rapidly assess the enemy intentions and quickly distribute critical information to concentrate his combat power at the right time and place. To survive, he must be able to disperse his resources for command and control. Our initial approach [involved the use of] a centralized minicomputer and associated electromechanical mass storage devices.
>
> That architecture resulted in a large, identifiable array of equipment and manpower--a critical node, little integration or commonality between functional systems, requirements for stable, sheltered environments for minicomputers and high unit cost. A survivable and viable C^3I system based upon such a centralized architecture is unaffordable in terms of both dollars and survivability. An attractive alternative . . . is the concept of a distributed C^3I architecture with a microprocessor assuming a major role . . . [the] advantages of a distributed C^3I system include:
>
> o survivability--no critical nodes. The loss of a microprocessor system does not result in a breakdown of the total system and allows graceful degradation.
>
> o commonality of hardware leading to lower acquisition cost and ILS [Integrated Logistics Support] investment.
>
> o common ADP architecture.
>
> o software flexibility.[51] [Italics added]

In the Spring of 1982, the Signal Center initiated its OMEGA Study, and was directed by DA message "to prepare and present a briefing to the Deputy Under Secretary of Defense for Command, Control, Communications and Intelligence (C^3I) on Mobile Subscriber Equipment (MSE) and its relationship to other programs."[52] The study revealed adherence to the TRADOC-generated Concept Based Requirements System (CBRS) when it introduced the results of the Tactical Communications Mission Area Analysis (TCMAA). From the study came the realization that the C^3I system must find and provide communications support to the customer, and

not burden the customer with a ton of telephone directory changes. Even if a capability existed to make the changes and distribute them, which it does not, TRI-TAC was not taking advantage of "flood-search" automatic switching technology whereby the microprocessor locates the customer and routes a call to him using his unique, and never-changing identification call number. Candidly, the study revealed that

> current approved O&O [Operational and Organizational Plan] Concepts and Plans . . . do not present an easily recognized definition or distinct picture of the communications architecture . . . [and] the bottom line result is a less than complete picture of the purpose and intent of each [of the three systems].[53]

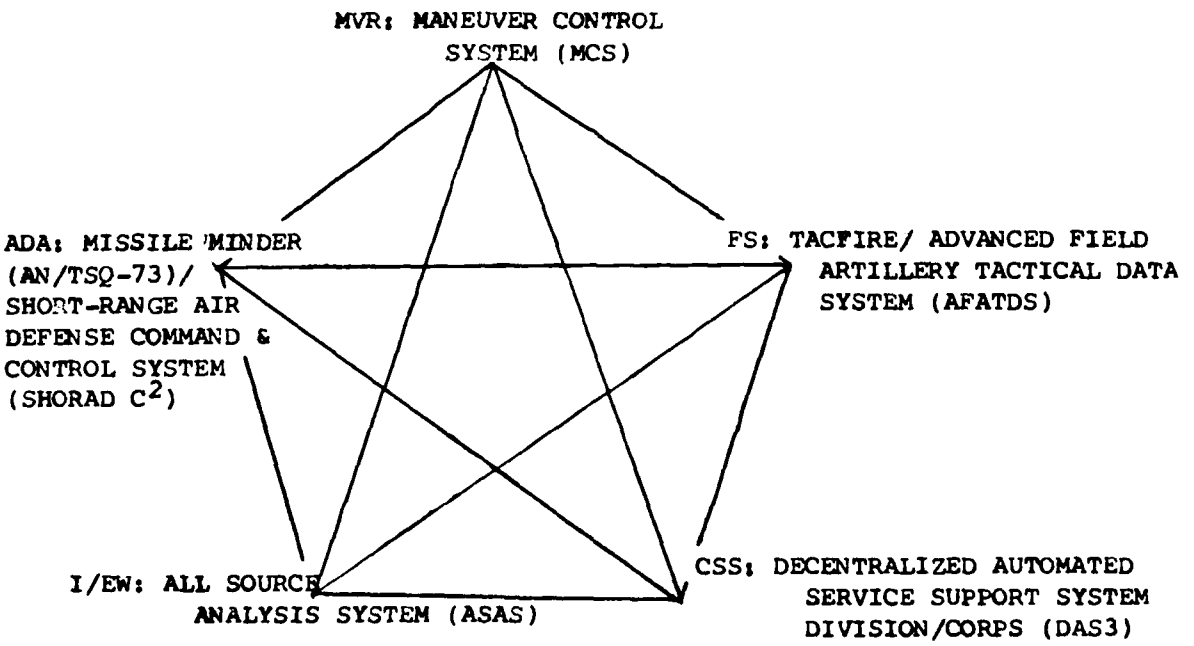
Position Location Reporting System/Joint Tactical Information Distribution System Hybrid (PLRS/JTIDS Hybrid)

One factor that the OMEGA study focussed on was the relative information-carrying capacities of MSE, SINCGARS, and the PLRS/JTIDS Hybrid (PJH). PJH was originally intended to handle low volume/high throughput traffic to service air defense, fire support and intelligence subscribers. On the other hand, MSE and SINCGARS are designed to handle high volume telephone voice and facsimile traffic that has a relatively slow throughput. The sizing of the "pipeline" to satisfy real time data requirements remains an area without a complete answer. In an attempt to answer this question, PLRS prototype units were deployed to Europe to support REFORGER in 1984. Commenting on air defense artillery (ADA) at the JTC^{3}A conference this year, General Glenn K. Otis, Commander in Chief, US Army Europe lauded the system and advised that its success depended on three factors:

> One, the capability to have the range necessary from a platform to a down station. Two, that the communications themselves will work, even in a jamming environment. Three, that almost every one

> of these has an embedded computer that must first sort out the variety of signals that are meaningless and produced only the meaningful information to that pipe to the ground station link. . . .
>
> In the Air Defense System--each of those links is now a communications device that must take information that is coming in from aerial platforms like AWACS [Airborne Warning and Control System], ground reports from front-line units and put it together into one battlefield picture. Then retransmit that information to the guns, whether those guns are surface to air missiles, scrambled aircraft, or some front-line manpack Stingers.[54]

What General Otis describes from a combat user's standpoint, is within the design parameters of the PJH. Add in the command and control capabilities of the Maneuver Control System (MCS) which is already deployed in Europe in limited numbers, and the battlefield automation systems destined for the intelligence (e.g., All Source Analysis System) and logistics communities and the SIGMA-Star model looks like this:



The operational concept spelled out by the Commander in Chief, United States Army Europe (USAREUR) is qualified by his experience as the NATO Central Army Group (CENTAG) Commanding General. As General Otis states:

> . . . No corps in the Army in Europe is going to operate as a US Army corps. For example, one of the two US corps in wartime and exercises has an embedded German division. Hence, either [MCS] must interoperate with the HEROS (German), or WAVELL (British) system or, it will be less than fully useful.
>
> [On the subject of TACFIRE] . . . it is not user friendly. Secondly, the decay of learning is rapid, and hence one must use it consistently in peacetime in order that it is ready to be used in war. Moreover, it has to interoperate with its German counterpart, and hopefully with its British and other national counterparts as they produce their systems.[55]

Mobile Subscriber Equipment (MSE)

The MSE architecture is based on the signal center node concept that has been operational since the 1940's. An area (vice command point-to-point) grid system which forms a multichannel/"backbone" network of individually interconnected nodes, the concept has come to be known as the Mobile Subscriber Grid System (MSGS).[56] Its greatest advantage is in protecting the identity of the subscribers which it services. For like a fish swimming in a sea, the user can "affiliate" with the system through Mobile Subscriber Radio Terminals (MSRT) served by over 100 Radio Access Units (RAU) operating within a typical 5-division corps area of operations. As Army Communicator magazine describes the system:

> To accommodate the projected densities of mobile subscribers, each RAU will service up to 25 mobile subscribers while maintaining a 90% first attempt call completion rate.

> The MSE system will locate subscribers of the system without knowing their geographical locations. . . . Selection of transmission paths is without routing tables [or switchboard operators] and is based on [radio or cable] link availability and traffic loading at the time of call initiation. This will allow unconstrained use of a fixed directory numbering system. . . .
>
> [Survivability is enhanced because the] . . . system is resistant to failure . . . [and] adapts to destruction or expansion in that connectivity automatically provides transmission path without human intervention. . . .[57]

With upwards of 56 nodes available to support a full-up corps area of operations (as compared to the 16-node TRI-TAC configuration), the MSGS should prove itself during operational testing equal to the task of supporting AirLand Battle doctrine. In order to comply with the Army Vice Chief of Staff's guidance to down-size the Army Signal Corps, the organizational concept for MSGS calls for a restructuring of the Armor, Infantry, Mechanized (AIM) division signal battalion from a Division 86 (Army of Excellence) strength of 783 down forty percent to 422. Heeding the advice of General Otis and those like him, one minimum essential characteristic of the MSGS is NATO interoperability. As the TRADOC-developed operational concept (Operational & Organizational Plan) calls for:

> Interfaces to NATO military and to host nation commercial systems must be provided.
>
> The NATO interface capability may initially be an analog interface designed IAW STANAG [Standardized Agreement] 5040. If so, it will be replaced as indicated in Chapter 2 [Operational Capability Need] to a secure digital interface IAW STANAG 4206-4211 not later than 1990.[58]

CONCLUSIONS

This chapter began with a call from Ambassador Komer that we must develop a coalition and joint military strategy in the way that we conduct the force development process. This same theme was echoed by the Commander in Chief United States Army Europe (CINCUSAREUR), General Otis who reminds us we are not going to fight the next war alone, but that cross attachments of units with our Allies will become the norm rather than the exception.

Whether supported "by the weight of the evidence systematically studied"[59] or not; whether the AirLand Battle is an operational concept or doctrine; whether there is a sufficiency of field trials and large-scale field exercises to provide accumulated data to support scientific analysis, all of these considerations are moot when the alternative is contemplated. As the lesson-learned with C^3I interoperability illustrates, without a unifying doctrine, however incompletely tested, the force development process flounders. In this regard, the AirLand Battle doctrine is now providing the "umbrella" concept on which TRADOC's Concept Based Requirement System (CBRS) is based. And, with inputs from the field, such as that provided by General Otis during the August 1985 Joint Tactical C^3 Agency (JTC^3A) Conference, the research, development and acquisition (RDA) process will flow from user-generated (vice technology-driven) requirements. As the current Deputy Chief of Staff for Research, Development and Acquisition, Department of the Army, LTG Louis C. Wagner states:

> We . . . need to concentrate on defining requirements completely and clearly at the outset of a development, so it can be 'designed right' the first time, without false starts. We cannot afford

> the 'I think this is what I want' approach to systems design. The user has to step forward and state clearly that a requirement exists. Those responsible for requirements must clearly define the parameters; and the [materiel] development community has to quickly and economically build to the requirement, eliminating wasteful redesign.[60]

Is the AirLand Battle doctrine fully mature? It certainly is not. It will continue to mature until the structure of the military forces matches the national military strategy imposed upon it. Who, today, can predict for example whether the Mobile Subscriber Grid System (MSGS) concept or the GTE Corp./Thomson CSF-built Mobile Subscriber Equipment (MSE)[61] will meet the minimum essential operational characteristics spelled out in the MSGS Operational & Organizational (O&O) Plan? And, if NATO interoperability requirements are met, will MSE also satisfy the C^3I requirements of a contingency corps committed to an immature theater mission in Southwest Asia (SWA)?

It may be well into the next decade before there's enough accumulated experience to answer questions such as these. But, this does not diminish the fact that the principles (C^3I fundamentals): distributed C^3I; user-operated terminal devices, survivable "nodeless" communications networks; tactical automatic telephone, facsimile switching,[62] etc., have been proven-out by our NATO Allies many times over through field testing. When US technology proved itself incapable of meeting the MSGS concept, it was the demonstratableness of the RITA (French) and PTARMIGAN (British) systems, rather than their hardware sophistication, which attracted US Army attention and eventually resulted in a Non-developmental Item (NDI) materiel acquisition.

On the other hand, the Joint Tactical Communications (TRI-TAC) Program could not satisfy the above C^3I principles emanating from AirLand Battle doctrine. The Army and Air Force are now trying to develop a concept of employment for that TRI-TAC hardware already acquired and contracted for. This will be difficult, as theater operational concepts are in even a softer state of conceptualization than at the corps or division levels.

ENDNOTES

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3. Ibid., p. 19.

4. Senator Barry Goldwater and Senator Sam Nunn, Defense Organization: The Need For Change, (Washington, DC: Government Printing Office, 16 October 1985), p. 15.

5. Field Manual 100-15 (Coordinating Draft), Corps Operations, (Washington, DC: US Government Printing Office, 9 March 1982).

6. Field Circular 100-15, Corps Operations, (Fort Leavenworth: US Army Command and General Staff College, 6 March 1984), p. i.

7. Field Manual 11-92, Combat Communications Within the Corps, (Washington, DC: Department of the Army, 1 November 1978).

8. US Readiness Command Pamphlet 525-8/ US Training and Doctrine Command Pam 525-45/ US Air Force Tactical Air Command Pam 50-29, General Operating Procedures For Joint Attack of the Second Echelon (J-SAK), (Fort Monroe: US Army Training and Doctrine Command, 31 December 1984.

9. Through the National Training Center (NTC) Operations Group, Fort Irwin, CA can be obtained the one hundred or more, Observer-Controller (OC) NTC Training Observation and Lessons-Learned Reports. Starting in Mid-1982 and continuing to the present, these reports constitute the type of systematic analysis and study from which doctrine and combat principles can be derived and incorporated into official publications.

10. MG I. B. Holley, Jr., Air Force Reserve (Ret.), "Concepts, Doctrines, Principles: Are You Sure You Understand These Terms?," Air University Review, July-August 1984, p. 92.

11. Field Circular 100-15, p. 1-9.

12. GEN Donn A. Starry, USA (Ret.), "To Change An Army," Military Review, March 1983, p. 21.

13. Ibid.

14. GEN Donn Starry, p. 21. Another interesting article tracing the development of German technological and doctrinal change is by MG J. W. Woodmansee, Jr., "Blitzkrieg and the AirLand Battle," Military Review, August 1984. MG Woodmansee was the Commander, 2d Armored Division, Fort Hood, TX, and is currently in thee Office of the Deputy Chief of Staff for Operations and Plans (ODCSOPS), Force Development (DAMO-FD),

15. Ibid., p. 22.

16. TRADOC Pamphlet 525-5, US Army Operational Concept: The AirLand Battle and Corps 86, (Fort Monroe: US Army Training and Doctrine Command, 25 March 1981).

17. Ibid., FORWARD, signed by GEN Donn A. Starry.

18. Millard Barger and Benjamin F. Schemmer, "An Exclusive AFJ Interview With GEN John A. Wickham, Jr., Chief of Staff of thee Army," Armed Forces Journal International, October 1985, p. 46.

19. Ibid.

20. MG Sam Damon, USA and BG Ben Krisler, USA [BG John C. Bahnsen, Jr., USA] "'Army of Excellence?' A Time To Take Stock," Armed Forces Journal International, May 1985.

21. Paul Hersey and Kenneth H. Blanchard, Management of Organizational Behavior, (Englewood Cliffs: Prentice-Hall, Inc., 1972), p. 9.

22. Ibid., p. 13.

23. MG Edward B. Atkeson, USA (Ret.), "Flexibility Is The Key: The Options in Europe," Army, May 1985, p. 27.

24. R. J. Raggett, "Soviet C^3I and the Question of Technology Transfer," Signal (Journal of the Armed Forces Communications and Electronics Association), December 1985, p. 17.

25. DA Pamphlet 600-50, White Paper 1985: Leadership Makes the Difference, (Washington, DC: US Government Printing Office, 1 April 1985), p. 3.

26. Field Manual 101-5, Staff Organization and Operations, (Washington, DC: US Government Printing Office, 25 May 1984), p. 1-1.

27. Ibid., p. 1-2.

28. Raggett, p. 18.

29. Field Manual 101-5, p. 1-2.

30. GEN Bruce Palmer, Jr., USA (Ret.), "The Pentagon: Caught in the Chains of Command," Washington Post, October 1985, Business Week Section. GEN Palmer, former Army Vice Chief of Staff reviews the book by James Coates and Micheal Killian, Heavy Losses: The Dangerous Decline of American Defense, (Viking). According to the authors:

> . . . We lack a cohesive overall strategic concept to guide our defense leaders; that there is a pervasive over-emphasis on nuclear weaponry with a corresponding neglect of conventional forces; . . . [and that] we are on the way to building a far more costly defense establishment largely because of a vast DOD-industrial-congressional complex that is driven to a great extent by self-interests and is corrupting our officer corps. [Italics added]

31. MG Atkeson, pp. 28-29.

32. US Army War College Publication, Application of Power: Theater Forces "OVERLORD-Campaign Planning," (Carlisle Barracks: USAWC, 5 January 1986), p. 97: Reprinted from: US Army. First Army. Report of Operations, 20 October 1943-1 August 1944: Annex No. 1 and 2. N.p.: n.d., pp. 13-88.

33. Army Regulation 70-10, Test and Evaluation During Development and Acquisition of Materiel, (Washington, DC: Department of the Army, 29 August 1975), pp. A-4 to A-5. Army Regulation (AR 34-1), US Army Participation in International Military Rationalization/ Standardization/Interoperability (RSI) Programs (DA, 1979) has as the definition for Interoperability:

> The ability of systems, units, or forces to provide services to and accept services from other systems, units, or forces and to use the services so exchanged to enable them to operate effectively together.

34. Field Manual 100-5: Operations, (Washington, DC: Department of the Army, 20 August 1982), pp. 7-2 to 7-3.

35. Materiel quoted from US Army Logistics Management Center publication ALM-31-4784-LC(D), titled: The Life Cycle Model. The ALMC cites as a reference for its publication a DRCIRD letter, Subject: DOD Consolidated Guidance, FY 81-85 Pertaining to NATO RSI, dated 8 June 1979.

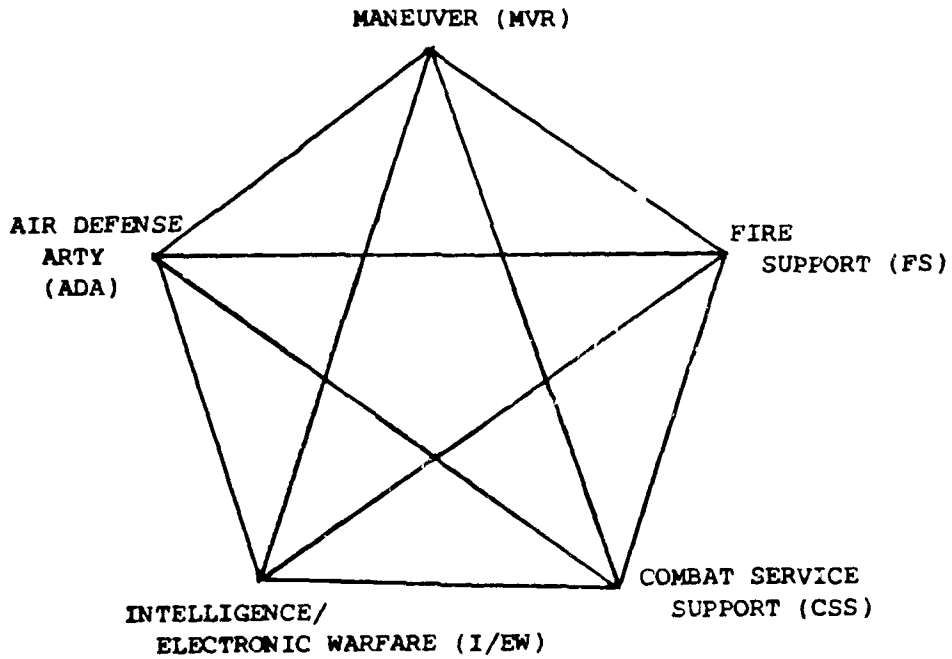
36. DARCOM Handbook 700-1.1-81: Primer ILS: Integrated Logistic Support, 2d Edition; now the Army Materiel Command (AMC vice DARCOM), establishes the fact that under DOD Directive 2010.6, decision reviews during the life cycle of a materiel development program will consider:

1. Applicable new systems/equipment under development or in production by NATO allies or other countries.
2. Adjustment of schedules to accommodate cotesting and codevelopment with NATO allies.
3. Opportunities for NATO allies to participate in *development or production* of new US systems.
4. Interoperability of US systems with those of NATO allies. [Italics added]

37. Army Logistics Management Center, p. 15.

38. MG Atkeson, p. 29.

39. The Office, Assistant Chief of Staff for Information Management (OACSIM) Department of the Army is responsible for the Information Mission Area (IMA), for developing and maintaining the theater/tactical Army Command and Control System (ACCS) architecture and is the proponent for the Army Command and Control Master Plan (AC^2MP). A conceptual model for viewing the tactical architecture is the SIGMA-Star depicted below:



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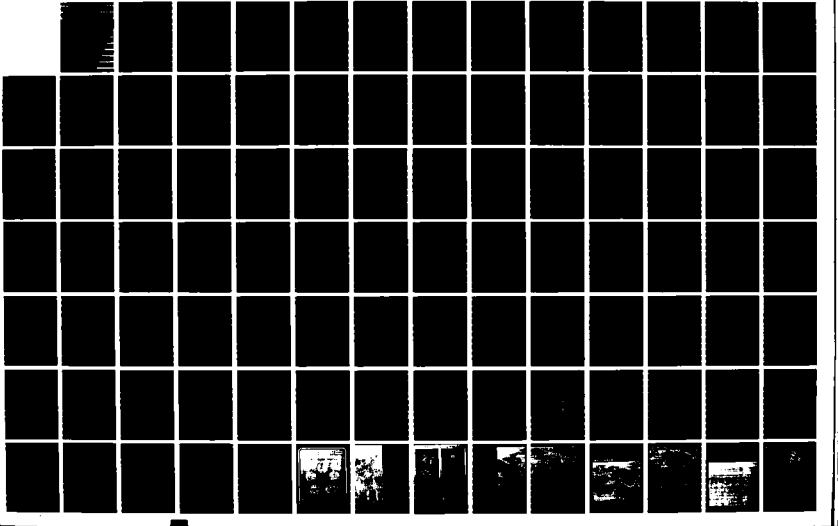
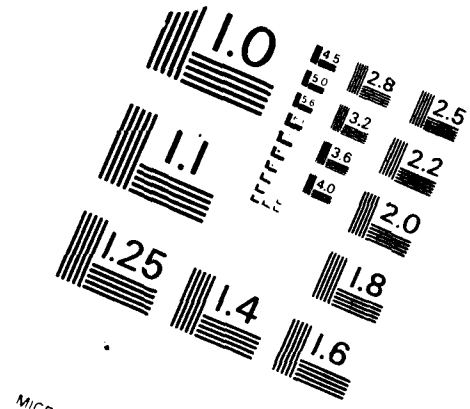




40. The Secretary of Defense's Annual Report to the Congress for FY 1986 contains the following on p. 150:

> Army Data Distribution System (ADDS)--A digital communications system, the ADDS will provide secure, jam-resistant communications links for command and control, intelligence, air defense, fire support, electronic warfare, and other computer systems. The FY 1986 budget provides initial procurement funds, working toward a planned deployment date in FY 1988.

41. LTC George F. Kolesar, USA, "The Architecture Goal: Systems that 'Talk'," Army, July 1985, pp. 36-39. LTC Kolesar is assigned to the Office of the Assistant Chief of Staff for Information Management (OACSIM), DA.

42. LTG C. E. McKnight, Jr., USA, "Solving the Interoperability Problem," Signal, November 1985, p. 19.

43. Dr. Jon L. Boyes, VADM, USN (Ret.), "Tactical C^3I Interoperability and the Somme," Signal, November 1985, p. 16. Dr. Boyes reports on the 14 March 1985 testimony of Asst. Sec. of Defense (ASD) for C^3I, Mr. Donald C. Latham before the Senate Armed Services Committee, who it was that made the comment on the frustration over establishing a DOD Directive. Also cited was the Goldwater-Nunn Study (16 October 1985) which

> . . . states that without effective mission integration, unification of the services means little. . . . Senator Nunn offered other examples of command, control, communications and intelligence (C^3I) noninteroperability, such as the Iran rescue mission (1980) and Grenada (1983). Another example that might be added is the Cambodian piracy of the US merchant ship Mayuguez (1973). There, as a result of a lack of interoperability and poor C^3I, US forces were unduly exposed to hostile fire and endangered.

44. LTC Kolesar, p. 36.

45. US Army Logistics Management Center (ALMC) publication ALM-31-2914-H2(B), titled: "HQDA View of Development Test and Evaluation (DTE)." Refer to Army Regulation 70-10, p. A-2.

46. Caspar W. Weinberger, Annual Report to the Congress: Fiscal Year 1986, (Washington, DC: US Government Printing Office, 4 February 1985), pp. 149-150.

47. US Army War College Publication, Army Command and Management: Theory and Practice, (Carlisle Barracks: USAWC, 19 August 1985), p. 12-4.

48. Martin Van Creveld, Command In War, (Cambridge: Harvard University Press, 1985), pp. 236-248. Mr. Creveld cites specific examples of the malaise which afflicted the Command and Control network in Vietnam:

> That all these factors together-specialization, instability, centralization, complexity; and the resulting information pathologies [defined on p. 316 as 'the inability of organizations to obtain a clear, timely picture of their surroundings and their own functioning, owing to structural defects']--did in fact cause a serious slowdown of the command [and control] process can readily be proved from the extraordinarily long periods that were often required to plan, prepare, and mount operations. Thus in the fall of 1967, the operations 'Cedar Falls' and 'Junction City' each employed more than two divisions, and each required some 4 months from decision to action. . . .
>
> The real point of the story, however, is that while up-to-date technical means of communication and data processing are absolutely vital to the conduct of modern war in all its forms, they will not in themselves suffice for the creation of a functioning command system, and that they may, if understanding and proper usage are not achieved, constitute part of the disease they are supposed to cure. . . .
>
> To study command as it operated in Vietnam is, indeed, almost enough to make one despair of human reason; we have seen the future, and it does not work.

49. LTG David K. Doyle, USA, "The Army Perspective," published minutes from the August 1985 Joint Tactical Command, Control and Communictions (C^3) Agency (JTC^3A) Conference held at Fort Monmouth, JG. GEN Doyle is the Assistant Chief of Staff for Information Management (ACSIM), Department of the Army.

50. COL Daniel Gans, USAR (Ret.), "Fight Outnumbered and Win," Military Review, December 1980, p. 37.

51. LTG Donald R. Keith, USA (Ret.), "Distributed C^3I--A Force Multiplier for the 90's," Signal, September 1981, p. 11. Before his retirement, GEN Keith commanded the Army Materiel Command (AMC).

52. MG Henry J. Schumacher, letter, Subject: "Objective Division Communications Architecture (OMEGA Study)," (Fort Gordon: US Army Signal Center, 3 September 1982). Another letter, same subject, dated 16 July 1982 stated that:

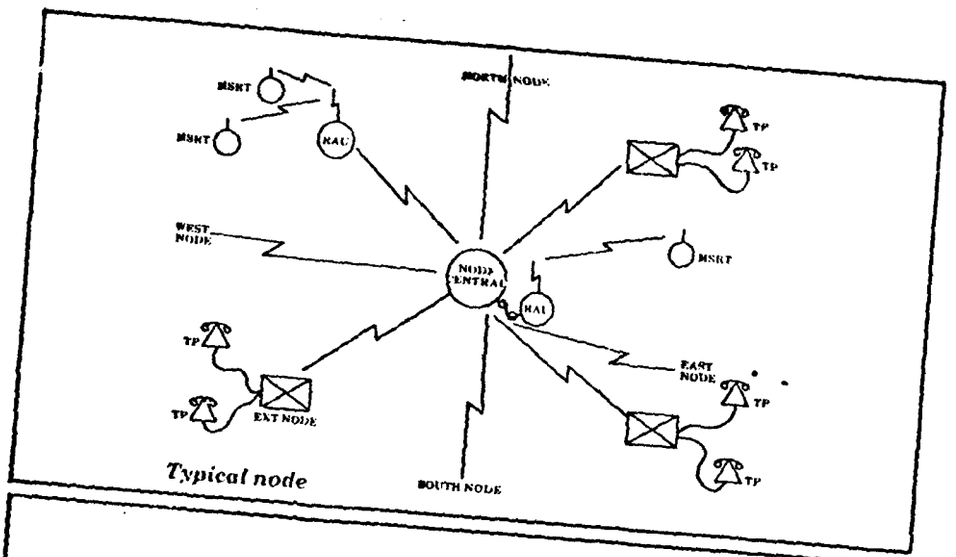
> the OMEGA Study (enclosed) was initiated as a result of DA MSG DAMO-C4 032115Z Feb 82 whereby the Signal Center was tasked to prepare and present a briefing to the Deputy Under Secretary of Defense for Command, Control, Communications and Intelligence. . . .

53. Ibid., p. 1-3.

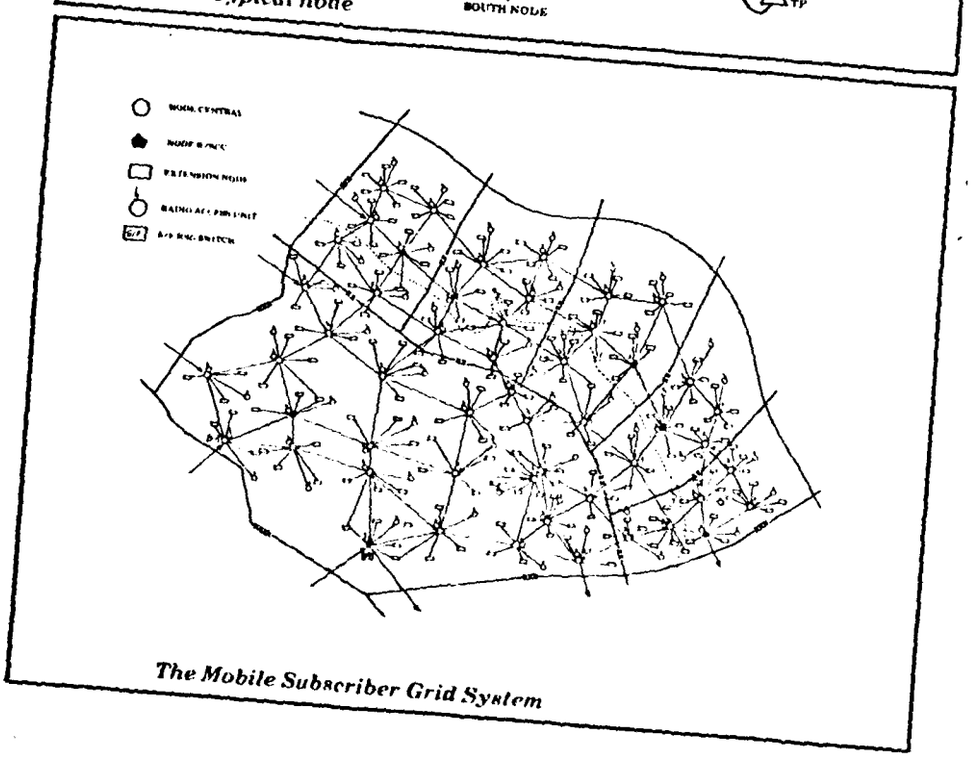
54. GEN Glenn K. Otis, USA, "Where It Has Worked," published minutes from August 1985 JTC^{3}A Conference held at Fort Monmouth, NJ., p. A-31.

55. Ibid., p. A-29.

56. The following Mobile Subscriber Equipment (MSE) and Grid System (MSGS) diagrams were extracted from: "MSE: The Operational Concept," Army Communicator, Fall 1984, p. 9.



Typical node



The Mobile Subscriber Grid System

57. Ibid., p. 10.

58. Operational and Organizational Plan for Mobile Subscriber Grid System (MSGS), (Fort Gordon: US Army Signal Center, January 1984), pp. 4-10. The 1990 timeframe for digital operations is indicative of the evolutionary [i.e., P^3I: preplanned product improvement] approach of the MSGS/MSE developmental effort.

59. MG I. B. Holley.

60. LTG Louis C. Wagner, Jr., USA, "Soldier-First Attitude Has 'New Prominence'," Army 1985-86 "Green Book," October 1985, p. 256.

61. Micheal Weisskopf, "French, US Firms Win Army Contract," Washington Post, 6 November 1985, p. F1. Mr. Weisskopf reports that the consortium of the Paris-based concern of Thomsson CSF and the US GTE Corp. submitted a contract bid $3.1 billion lower than the London-based Plessey Defense Systems/Rockwell International Corp consortium. The winning bid was $4.3 billion.

62. The tactical automatic switching capability listed in the O&O Plan as a minimum essential characteristic was originally published in a TRADOC Pamphlet 525-39: Automatic Switching, (Fort Monroe: US Army Training and Doctrine Command, 11 June 1984). Three operational capabilities of the switching network embedded in the Mobile Subscriber Grid System (MSGS) which will facilitate the fast-paced and dynamic nature of the AirLand Battlefield are the following:

> o 'Smart' Routing: Used to describe automatic routing of calls with no human [switchboard operator] intervention and without the requirement to manually determine the route over which a given call can or should be routed [through the MSGS].
>
> o Tandem Switching: Switch [board] that processes calls which must be routed from an incoming trunk to an outgoing trunk [automatically] . . . neither the calling nor the called party are located at the switch [immediate location] in a tandem trunk call.
>
> o Flood Search: [Employing a 'fixed' telephone directory system] flood search reduces telephone directory data base maintenance requirements [i.e., making changes, publishing and distributing] since telephone numbers are related to organizations and positions, as opposed to telephone instruments. Telephone numbers move with subscribers and are permanently assigned or 'fixed' to designated subscribers. Flood search signalling and 'smart' routing provide a system with increased flexibility and survivability resulting in better service to the user in a rapidly changing tactical environment.

Flood search finds subscriber numbers wherever they are located on the AirLand Battlefield.

CHAPTER III

USER REQUIREMENTS: Lessons-Learned and Relearned from a C^3I Perspective

> Our vast technological advances have imposed and enormous mental burden on people in all walks and levels of life. In the military and its associated political, industrial, and scientific people, the lack of an accepted body of military theory and principle leaves a void in the basic philosophy that should guide people in distinguishing between cause and effect, between the important, between the central and the peripheral.
>
> Human nature, particularly human pride, tends to create in men instinctive defense mechanisms that resist all criticism as personal disparagement. This makes thorough objective analysis both difficult and rare.
>
> These two major factors combine with other less important factors in such a manner that the mistakes of the past are repeated. Sometimes this repetition is so apparent as to seem due to deliberate stubborn intent; sometimes it is clearly a matter of good people never finding time and guidance to set their minds to the proper question.[1] [italics added]
>
> Rear Admiral Henry E. Eccles, USN Ret., Military Concepts and Philosophy.

INTRODUCTION

At the time of this writing, the Congress, OSD and the Joint Chiefs of Staff (JCS) are being taken to task by Senators Goldwater and Nunn for trying "to micromanage the military (Services) by focusing on one little program after another rather than focusing on how to build a coordinated defense force."[2] Inter-Service rivalries, as we witnessed in Chapter Two, abound in their methodology for executing a force projection strategy[3] in an immature or contingency theater area of

responsibility (AOR), particularly when doctrinal interpretations and "turf" issues involve close and deep battle doctrine and principles. A USMC officer who recently served on the OSD staff as director of manpower planning and analysis gives us some insight into one close battle issue; namely, close air support (CAS):

> . . In the air Force, a caste system prevails among pilots. The Brahmins are fighter jocks committed to air-to-air battle. Strategic bomber crews, part of another unique Air Force mission, enjoy second-banana status. Lowest in prestige are the [close air support] "mud pilots," who fly the boxy A-10 "Warthog" in close (battle) support of the Army.
>
> "You have to understand," explains one expert, "when the Air Force talks [BAI: battle field air] interdiction, of strikes deep in thee enemy's rear, it's really talking about getting away from the Army."
>
> The Air Forces's disdain for its Army-support mission is evidenced by the fact that the A-10 is no longer in production, and no replacement is in sight.[4]

In Chapter One we examined the issue of our NATO Allies pursuing a Follow-on Forces Attack (FOFA) concept in the implementation of the Flexible Response strategy. Because of its implication for the employment of air-ground C^3I assets and the distribution of target acquisition and surveillance data with high through-put (speed) requirements, it is in the best interest of all Services and particularly the Army Signal Corps to see a resolution of FOFA and AirLand Battle doctrine differences as soon as possible. But, before we can hope to see a convergence in what may be only a "philosophical difference related to FOFA and joint (air, missile and maneuver) interdiction,"[5] the Army and Air Force have to come to terms with the issue of close-air support (CAS) from a doctrinal development standpoint. It means little to the soldier on the ground if the

"Europeans tend to view the placement of the FSCL (fire support coordination line) as about 15 to 25 kilometers (vice the US Army's 75 kilometers) from the forward line of own troops (FLOT),"[6] when the joint air-ground doctrine (Field Manual 100-26: The Air-Ground Operations System) does not provide him an adequate margin of safety from "friendly force" air strikes in the close and rear battle areas. In the words of Ambassador Komer "the United States does not have even a unified (joint) strategy, much less a coalition one."[7] And, when one considers that the latest draft of FM 100-26 is almost 13 years old, it appears that we are delinquent in setting our own house in order, and underscores the Washington Post article cited in Chapter One that "nobody gives a good goddam about the infantry."[8]

The CAS issue is a good example of doctrinal development problems delaying the application of state-of-the-art technology. Both in the technological areas of night-vision devices and C^3I data distribution systems (e.g. PLRS/JTIDS Hybrid), the combat arms user has been denied access to the Army Force Development and RDA processes for a materiel solution or, at least, an enhancement of a close battle requirement.[9] For the lack of or an adherence to operational concept or practical list of tactical principles, how many more technological innovations are there waiting to be discovered by the soldier in the field? One that comes readily to mind is the disuse of Radio-Wire Integration (RWI) at the division and Corps levels which resulted in the cancellation of Project MALLARD (radio-telephone technology) due to the lack of user support (advocacy). What other C^3I innovations are required to enhance the survivability of the command post, the remote radio relay, the terminal, or the High Frequency (HF) radio terminal with its

susceptability to enemy Radioelectronic Combat (REC) measures. Operations Security (OPSEC) is an area we cannot reserve for "the real thing" if we are to depend on field exercise fidelity to prepare us doctrinally and materially for combat. As we are reminded in an November 1981 article in Military Review:

> If your TOC (tactical operations center) sounds like Grand Central Station, is lit up like the annual Christmas tree in Rockefeller Square, emits electromagnetic radiation like Television City, or is the size of the Barnum and Bailey Circus, you won't have to worry about fatigue after weeks of operation. You will just be a memory and a feather in some enemy artilleryman's cap.
>
> Advice on how to slim down a TOC is cheap. Just move the [battalion] TOC every three hours, day and night, for the duration of a major field training exercise. Unfortunately, this is another situation where you cannot afford to have the troops sitting around while you get your act together.[10]

A LESSON-LEARNED: Close-Air Support (CAS)

BACKGROUND

Anyone who has assigned to US Army Europe in the late 1970's will recall the daily exposure on Armed Forces Network Television (AFN-TV) of the newly introduced A-10 Thunderbolt II, close air support (CAS) aircraft. At about supper-time, 2 or 3 times each week, soldiers and the families of soldiers were treated to a minute or so of video-taped demonstration of the awesome tank-killing power of the A-10 with its 30mm GAU8 cannon. To those of us in the 8th Infantry division (MECH) stationed at Baumholder, Germany, the AFN-TV coverage had special meaning. Time after time during the Fall and Winter of 1977-78, we were witness to the A-10 air strikes conducted on the live-fire ranges at Baumholder, and in CAS mission support of the Army Training and Evaluation Program (ARTEP) field exercise-series: CARDINAL POINT. Knowing our General Defense Plan (GDP) mission and the overwhelming

superiority of the enemy armor threat force, CAS was counted on to equal the odds in antitank killing power. Never once during GDP "back-briefings" to the Division or V Corps Commanders did anyone disparage the A-10 aircraft by referring to it as the "warthog."

In the April 1978 issue of Military Review, we further learned of the effectiveness of the Luftwaffe's antitank aircraft, the HS129, during the July 1943 Battle of Kursk. The tactics used were "to attack from very low level and fire 30mm cannon at the side, rear and engine decking of the Russian tanks."[11] The German air commander credits the success of his tactics to its phasing of aircraft sorties "so that the enemy was never given an opportunity to rest, regroup or disengage." Rather than the predominantly preplanned air strikes experienced in executing the enclave and attrition war strategy of Vietnam, the article suggests that "the Luftwaffe historical experience indicates the need for forward basing of aircraft assets. . . in order to achieve the minimum time between the call for, and the actual employment of, air support."[12]

With its tactics developed around a optimum "slant range" of 4000 feet, the A-10 must operate close to the ground. However, as the author points out:

> . . .It has several [survival] advantages: terrain masking from threat radar, exposure to limited observation (the aircraft can only be seen from the immediate area over which it is flying), and within easy reach at the low-altitude blind areas of many surface-to-air missile systems (it is difficult to track an aircraft on radar at treetop level). Especially important is the fact that assets that the enemy puts into surface-to-air missile systems and sophisticated radar warnings are assets that he takes away from conventional antiaircraft artillery defense with probable significant increase in the survivability of the A10 because the main threat,

with which the A10 is concerned, is barrage anti-aircraft artillery fire.[13]

Another place where soldiers do not refer to the A-10 as the "warthog" is at the National Training Center (NTC), Fort Irwin, California. Observations made by former battalion commmanders, OPFOR (opposing forces) leaders, and Observer-Controllers (OC), indicate that a close working relationship exists between the ground and air elements during exercise play. Normally, Tactical Air Control Party (TACP) elements, "marry up" with Army ground forces before deploying to the NTC and remain throughout the 3 week training (rotation) period. The training value of the NTC experience cannot be over emphasized.[14] And, at first glance it appears that the Army and Air Force have in the NTC the same field-trail capability as the British and Germans had with the Salisbury Plain and Spanish Civil War prior to World War II. As the Germans innovatively applied the lessons-learned from field exercises and doctrinal field trials, the NTC has the capability of providing the realistic "wartime" conditions for spawning demand-pulled (vice technology-pushed) technological advancements.

C^3I IMPLICATIONS OF AIR-GROUND OPERATIONS

To appreciate the C^3I requirements for CAS, we must view it from the Corps and the operational level of war. For even though the NTC has been activated since 1981, its maneuver battalion and brigade orientation has not sparked any marked activity either in the Army or Air Force to upgrade CAS procedures or hardware. And, for illustration purposes, let's use the US Army War college's large, immature theater exercise, LITE-86. With its requirement for a US Central Command (USCENTCOM) force projection into Southwest Asia, and calling for task

organization that includes 72 A10 aircraft (home based with the 354th TFW, Myrtle Beach AFB, SC), the exercise is ideally suited for analyzing the role of the Air Support Operations Center (ASOC) which is "concerned primarily with the exchange of combat data between air and ground forces and the coordination and execution of close air support (CAS) of ground units."[15]

C^3I support of an element such as the ASOC-CTOC (Corps' Tactical Operations Center) is perhaps the most challenging on facing a tactical communicator. Charged by the operational concept contained in Chapter 6 to USREDCOM Pamphlet 525-8/TRADOC Pam 525-45/TACP 50-29: General Operating Procedures for Joint Attack of the Second Echelon, the Corps Signal Brigade will terminate the secure circuits of the ASOC. The type of subscriber service described (e.g. telephone, teletype, facsimile) does not reflect the impending distributed C^3I technology to be available by the end of this decade. The SIGMA-Star, "database-driven, display intensive command/control"[16] system outlined in Chapter Two (A Lesson-Learned: C^3I Interoperability) is not mentioned. Which leads one to conclude that digital data distribution to support rapid decision making hasn't made an impact yet on air-ground operations, nor has the concept that C^2 can be more effectively obtained "without a word being spoken."[17]

SYNCHRONIZATION: AN AIRLAND BATTLE FUNDAMENTAL

In his November 1984 Army article, "Toward a Balanced Doctrine: The Case for Synchronization" General Wm E. DePuy, US Army, retired cites the work being done to develop procedures for "air-land cooperation at the corps level." Using Field Manual 100-5: Operations as the central focus of his thesis, the reader is reminded that

"forceful and rapid operations achieve at least local surprise and shock effect. . .(commanders) must make specific provisions in advance to exploit the opportunities that tactical success will create."[18] General DePuy contrasts this principle of air-land combat to the Air Force:

> . . .[who] wishes to go about such operations in a deliberate manner involving careful planning and the employment of a number of support aircraft. . ..
>
> The unresolved problem arises when the Army requests the attack of moving enemy targets (for example, a tank division approaching on route A). The nature of these targets, the importance of them to the [Army] commanders and the response times required make the synchronized attack of these targets by Tactical Air command (TACC at air component headquarters level) are entirely incompatible with 24-hour planning cycles. The Air Force clearly is agonizing over this problem. It is unresolved.[19][italics added].

But, let's extend synchronization beyond the joint arena, and consider the coalition warfare scenario of LITE-86.[20] Within the CENTCOM Area of Responsibility (AOR) the Gulf Cooperation Council (GCC) nations could provide the following tactical air forces (aircraft types): Saudi Arabia: 192 fighter/attack; Oman: 43 fighter/attack/recon; United Arab Emirates: 24 Mirage a/c; Qatar: 15 fighter-bombers; Bahrein: 6 F-5A/B 'Freedom Fighters'; Kuwait: 30 A-4KU 'Skyhawk' fighter/attack and 17 F-18/C interceptors. When one considers the C^2 and language problems involved for the ACOC-CTOC and TACC to maximize the air interdiction (AI) and CAS potential for these many aircraft types, new and innovative ways must be sought.

CAS FROM THE INFANTRYMAN'S POINT OF VIEW

Let us assume that the Combined Task Force (CTF) Commander has melded all US, Saudi, and GCC forces in his command and is prepared "to deny enemy access into critical GCC territory and facilities and to

restore pre-war GCC state boundaries."[21] At D+15, the enemy attacks, with heavy armor penetrations experienced across the FLOT. The smoke and dust obscurants, together with the "mixed bag" of US/NATO country/Soviet armor vehicles makes positive identification of friendly forces extremely difficult during daylight hours, let alone during the night when the enemy has made his biggest advances. Let us also assume that for safety, air-delivered ordnance will be employed 1,000 meters from unprotected ground forces positions, and 200 meters when protected. The use of smoke grenades to mark friendly positions is encouraged, as well as colored panel markers, flares, tracers, etc.[22]

Writing in the September-October 1985 issue of Infantry magazine a former CAS pilot with Vietnam experience reminds us of the importance of C^3I in making air-ground operations work. First, an immediate "CAS request is called to [the maneuver] battalion and radioed directly to corps (or the highest opertional headquarters) by high frequency (HF) single sideband [SSB] radios operated by tactical air control parties (TACP's)."[23] Soviet REC units are particularly sentive to HF radio transmissions, and prioritize at a high level for their direction-finding (DF) efforts. With the HF groundwave traveling about 80 kilometers (50 miles) the enemy's DF capability is greatly enhanced.[24] But the amount of radio traffic has just begun. Colonel Offley, who is now an instruction at the Infantry School reminds us that:

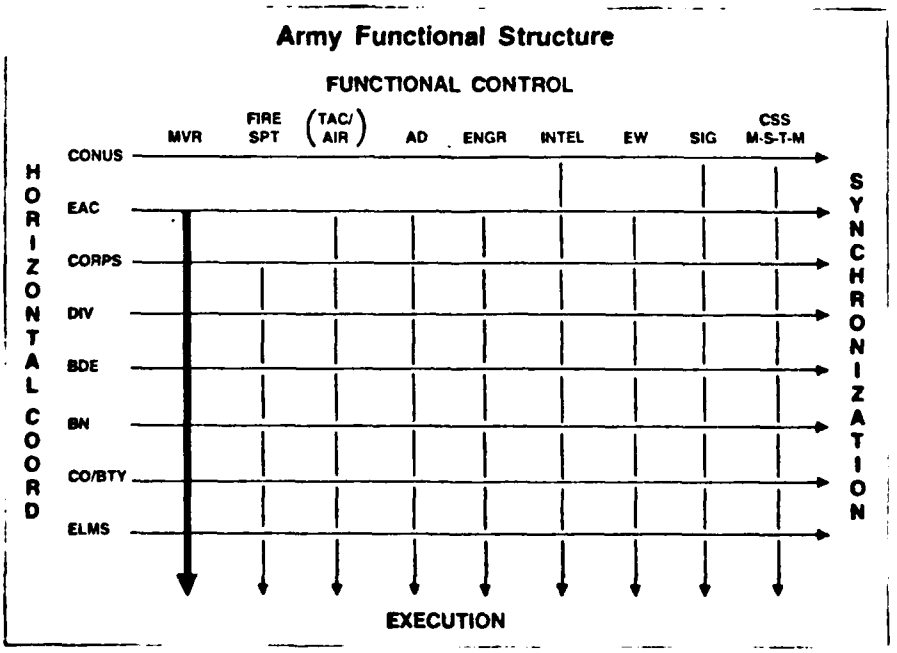
> Before we can drop air-delivered ordnance we must know at least where the friendiest are and where the target is, and we must have clearance to drop.... This lengthy communication includes start point, heading and distance to target, target area description, friendly position, abort code, ADA [air defense artillery] positions, and other remarks.[25]

We must assume that this information transfer between a CAS pilot and the Forward Air Controller (FAC) is not interfered with by enemy electronic-welfare (EW) jamming or deception. If jamming is a problem:

> . . .The briefing is relayed to a rear area command post or a forward air coordinator (airborne), who in turn relays the mission briefing to the fighter in an area away from the threat of jamming. The forward FAC then needs only minimal radio contact to put ordnance on the target. (The US Air Force Air Ground Operations School teaches that CAS cannot be accomplished without at least minimal radio contract with the pilot.)[26] [italics added]

STATE-OF-THE-ART TECHNOLOGY

Let's return to General DePuy's Army magazine article on synchronization. In the article he builds a model in which the Army "actually consists of parallel, echeloned, vertically integrated and individually controlled functional systems."[27] The functional controls include the same elements in the SIGMA-Star model described in Chapter Two. But, General Depuy adds one additional function; namely: Tactical Air Control System. The relationship between these elements is depicted below:



This model serves us well as conceptual framework for understanding the "synergistic" effect of battlefield synchronization, where the "cooperative action of discrete agencies (functional controls) such that the total effect is greater than the sum of the effects taken independently."[29] And the functional controls don't stop at the rear boundary of the Corps or the Theater AOR either. They are "multi-echeloned." As General DePuy describes:

> . . .Some, like intelligence, extend all the way from the surveillance radar platoon or the intelligence officer of the infantry battalion up through the echelons all the way to Fort Meade, Md. Fire support extends from the forward observer (FO) with the maneuver unit through the battery and up to corps artillery. Air defense extends upward from the "Stinger" to the theater air force [commander.[29]]

The model suggests speed of information and raw data distribution both vertically (all the way to the National Command Authority level, if required) and horizontally (e.g., the maneuver unit monitoring the informational input of air defense radars as displayed on the Tactical Computer System in a Brigade (TOC). The C^3I program that offers the most immediate improvement in tactical air control operations is the Joint Tactical Information Distribution System (JTIDS). The program had its beginnings in the late 1960's as PLRACTA (Position Location Reporting and Control of Tactical Aircraft), and in 1974, the program was combined with a Navy program by OSD into the JTIDS program which involves all four Services. The need for rapid information transfer is reflected in a 1982 Signal article written by the former director of the Joint Program Office:

> The air war over North Vietnam demonstrated the difficulty in passing radar information on MIG activity to the fighter pilots who were about to be attacked. The UHF [Ultra High Frequency] radio got

> saturated with several people talking at once and the information was based on map or ground checkpoints so the pilots had to make a coordinate conversion in their head to use the data.[30]

The first JTIDS (Class 1) terminals were deployed in 1983 in Air Force and NATO AWACS (Airborne Warning and Control System) E-3A aircraft. Ranges out to 300 miles have been experienced. The system has been successfully operated with the Marine Corps' Tactical Air Operations Center (TAOC) and the Army's AN/TSQ-73, Missile Minder System. The JTIDS technology will be a "boon" to ASOC operations in the Corps sector, and insure positive control of air defense artillery and SHORAD (Short Range Air Defense) assets. Using a lighter weight and smaller Class 2 terminal, which in 1983 was already available as full-scale engineering development (FSED) model,

> . . .flight tests have demonstrated the ability of Army air defense units to sort friendly and hostile aircraft via JTIDS and thereby engage only the enemy aircraft and not our own.
>
> Class 2 terminals [added] to fighter aircraft and Army tactical systems will provide the capability to send the air track data. . .In near-realtime where it can be displayed (e.g. on a ground forces TCT or aircraft HUD: (Head Up Display). The display provides a new degree of awareness so fighter pilots can see the tactical environment before they get engaged in it. Increased flight coordination with <u>fewer voice transmissions</u> and an increase in the number of aircraft a weapons controller can handle should also result.[31]
> [italics added]

Colonel Wells, USAF, leaves no doubt from his article, that the technology is in hand for expanding the JTIDS to satisfy other user requirements. For example, the JTIDS is being remarried with a position location capability like the original PLRACTA program. The Army/Marine Corps PLRS (Position Location and Reporting System) will be fielded in a

hybrid configuration: PLRS/JTIDS Hybrid (PJH). What the PJH will do for the two land force Services can be explained by referring to the Hughes Aircraft Company (HAC) brochure made available during the 1985 Association of the United States Army (AUSA) Convention in Washington, D.C. The brochure shows an artillery FO and SHORAD Stinger team with the man-pack version of PJH. With the system:

> . . .the forward observer's location and identification are automatically relayed back to the fire direction center without relying on an FM [CNR: Combat Net Radio] radio network. His data message goes out over the data communications system.
> .....
> With the PLRS/JTIDS Hybrid, Stinger teams operating in the forward battlefield area receive positive identification of all friendly aircraft in the SHORAD sector.[32]

The capability described above, is exactly what General DePuy was envisioning for increasing the "speed and efficiency of the synchronization process." And, when we consider the desert scenario of LITE-86, how can we expect aircraft pilots to make sense out of map coordinates or checkpoints when there are relatively few to choose form. And, when we realize the AirLand Battle will be predominately a night battle as dictated by the enemy's initiatives and relative strength in air superiority, the navigation problem becomes more acute. According to the HAC brochure, the modified Enhanced PLRS User Unit (EPUU) goes beyond the use of a navigation aid, but is an identification system also. "With this identification feature, helicopters operating over the battle field and maneuver elements on the battlefield can quickly locate and identify friendly units, even in the most dynamic tactical situations."[33]

When we consider the LITE-86 scenario, or even a low-intensity conflict (LIC), identification of friendly forces will be extremely difficult. And, the problem is made even the more difficult by the availability of M-60 tanks and M-113 Armored Personnel Carriers (APCs) to countries which could become adversaries of the United States. Couple the identification problem with a CAS pilot attempting to rendezvous with an air strike request during periods of enemy REC jamming, at night, and in a fluid battlefield situation calling for the dispersion of friendly forces the majority of which are not in prepared positions. In this situation, the CAS pilot will probably be guided to the target not by the digital data display of his HUD, but by the voice communications of the TACP and the inadequate attempts by the friendly forces to mark their positions with tracer ammunition, flaming arrows, etc. Identification by these means are clearly unsatisfactory. And, when triple-canopy jungle, dust and smoke conditions are added, they are almost totally useless as troop-safety measures. But, unless the Air Force equips its aircraft with a device which has capabilities similar to the previously described EPUU, the identification and location of friendly forces by USAF CAS pilots will not be conducted much differently than during World War II, the Korean War, or Vietnam.

An easy confirmation of this CAS hardware-shortfall can be made. Remembering that Service puts its dollars where its priorities are, the OSD's Annual Report to the Congress for Fiscal Year 1986 is a good place to begin a research. None of the four Services has addressed the employment of PJH technology as a Friendly Forces Warning (FFW) system on-board aircraft used in a CAS role. Together with the light and medium antitank weapon shortfall, the CAS limitation further underscores

the Washington Post article which comes close to the truth that "nobody gives a good goddam about the infantry."

A C^3I HARDWARE REQUIREMENT: Friendly Forces Warning (FFW) System for CAS aircraft

BACKGROUND

During the research for this chapter, the materiel need for the application of PJH EPUU technology to the CAS mission of high performance aircraft became apparent. Circumventing the normal combat development, TRADOC, and Army Force Development process, the requirement for a FFW capability was coordinated directly with the Office of the Deputy Chief of Staff for Operations and Plans (ODCSOPS), DAMO-FDQ, on 29 October 1985. ANNEX C is the single-page description of the materiel need and recommendation on how to apply state-of-the-art technology for resolving a troop-safety and AirLand Battle shortfall of consequential proportions.

This is not the preferred method for introducing a Defense Review Board (DBR) issue. Circumvention of the normal development process means that the Mission Area Analysis (MAA) process of the Concept Based Requirements System (CBRS) is not called into being for "an extensive assessment of Force capability with a particular battlefield or functional area."[35] Admittedly, Close Air Support (CAS) does not fall neatly into one of the fourteen (14) Mission Areas[36] assigned by TRADOC to one of its centers and schools. For now, let's assume that CAS is most closely associated with the MAA: Communications (Automation), and that the US Army Signal Center, Fort Gordon, GA is the proponent agent. Advocacy for a doctrinal, training, organizational or materiel solution to a problem begins with the TRADOC proponent insuring

that throughout the force development process the proposed solution (i.e. user requirement, JMSNS: Justification for Major System New Start, LOA: Letter of Agreement, ROC: Required Operational Capability, etc.) receives adequated decisionmaking review and prioritization within the annual PPBS cycle.

The importance of the MAA cannot be over-emphasized. The following except from a US Army War College text summarizes the important elements in the CBRS:

> . . .MAA determines deficiencies in present capabilities, identifies corrective actions, and develops those corrective actions in light of current technological opportunities. Materiel solutions generated in MAA provide the impetus for developing and Operational and Organizational (O&O) plan.
>
> An O&O Plan is based on functional operational [i.e. AirLand Battle, etc.] concepts and should be able to relate its origin to one or more of these concepts. The plan normally contains an operational, organizational, training, and logistical plan for the implementation of a hardware system within the Army organization. Equally important, the O&O Plan is a mandatory document that initiates the materiel acquisition [RDA] process.
>
> Finally, the Battlefield Development Plan (BDP) is created primarily to prioritize the key deficiencies identified across all [14] mission areas. The resulting prioritized list is translated into specific Army requirements. The complete MAA and BDP establish a clear direction for writing doctrine, developing new materiel systems, initiating changes in force structure, and developing training programs.[37] [italics added]

Without an adequate MAA, the FFW requirement may well go the way of the MALLARD Program (i.e. lack of advocacy). Or, as in the case of TRI-TAC, the cost-effectiveness of joint hardware development was allowed to overshadow the equally costly life-cycle costs of manpower (i.e. ceilings, grade structure) and training.

FORCE DEVELOPMENT PROCESS FUNCTIONS WHICH BODE WELL FOR THE FFW REQUIREMENT

Let's assume for purposes of illustration, that the FFW requirement, although assigned to the Army Signal Center for proponency, is of special interest to the Infantry Center (MAA: Close combat (light)) and to the Field Artillery Center (MAA: Fire Support). With these interrelated, but separate functional areas being brought to bear on the materiel solution a determination will made "if the synergistic effect of the combined corrections [manpower, training, doctrine, etc.] produces a viable force capable of executing required tasks."[38] This means that the Infantry Center invariably will insure that the FFW proposal meets the MANPRINT design requirements dealing with human factors, human safety, and performance of the total system (vice the hardware alone) under realistic combat conditions.[39,40] The Field Artillery Center, Fort Sill, OK, on the other hand, will insure that the Tactical Air control aspects of FFW will be interoperable with the existing five functional areas of SIGMA Star, namely: MCS: Maneuver Control System; SHORAD C^2; DAS3: Decentralized Automated Service Support System division Corps; ASAS: All Source Analysis (Intelligence) System; AFATDS: Advance Field Artillery Tactical Data System.

o LOGISTICS SUPPORT ANALYSIS (LSA): A prime tool in the Integrated Logistic Support (ILS) process of a materiel development, a contractor is required to perform a system of analyses on equipment operator and maintenance job-task, the sufficiency of technical manuals and test, measurement and diagnostic equipment (TMDE), the type and amount of training required and the need for training devices and simulators, and a host of other "ownership" considerations impacting on

the life of the equipment. Because of its impact on MANPRINT, the LSA Record (LSAR) data worksheets are the primary means of which the combat, training and developer can determine if logistics, maintenance, training and other performance characterisitic goals are likely to be achieved well in advance of Operational Testing (OT).

o CONTINUOUS COMPREHENSIVE EVALUATION (C^2E): In order to prevent surprises at the time of OT, the Operational Test and Evaluation Agency (OTEA) has begun to "focus on the evaluation of major system acquisitions (ie.e PJH); evaluate the system's progress in reaching its operational effectiveness objectives over its entire development cycle, not just at major decision points; and utilize all available information (i.e. LSAR) in the evaluating process."[41]

o PREPLANNED PRODUCT IMPROVEMENT (P^3I): the ODCSOPS sponsored Army Regulation 71-9: Materiel Objectives and Requirements now requires that all requirement documents include provisions for P^3I. The M-1A1 Abrahams Tank upgrade with the 120 mm tankgun is a P^3I case where the technology was not available early enough to outfit the first M-1 tanks coming off the assembly line. It "includes, but is not limited to, those improvements planned for ongoing systems which go beyond the current performance envelope (and enemy threat capability) to achieve a needed operational capability consistent with Mission Area Analysis, survivability, endurance objective, and the RDA Long Range Plan." The three phased program has the following objectives:

- o Shorten the acquisition and deployment time for military systems.
- o Extend the useful life of a system.
- o Reduce technical, cost, and schedule risk.
- o Reduce the requirements for major system new starts.
- o Improve system survivability and endurance.[42]

o DARCOM PAMPHLET 70-2/TRADOC PAMPHLET 70-2: In a joint effort, the materiel and combat (concept) development communities compiled the key policies and regulations involved in the RDA process into one publication. DARCOM, now Army Materiel Command (AMC) and TRADOC have recently republished the handbook on 20 January 1984 explaining that it "supplements the knowledge of experienced personnel, and its "cookbook" approach [i.e. heavily flowcharted, eschews Federalese-type language, etc.] makes it especially helpful to new employees unfamiliar with requirements generation and material acquisition. It will be maintained as an evolutionary [loose-leaf bound] document, changing and improving with your practical suggestions along with reflecting the latest changes to DOD and Army materiel acquisition policy."[43]

o USER ACCEPTANCE (ADVOCACY FOR CHANGE): Perhaps the one single factor which insures that the Friendly Forces Warning (FFW) capability and JTIDS itself will be thoroughly evaluated for its applicability to AirLand Battle doctrine and the operational level of war, is user involvement and ultimate consensus for making changes in military organization, doctrine, training and materiel structure. An example of the phenomenon called advocacy, occurred during the August 1985 Interoperability Conference hosted by the Joint Tactical Command, control and Communications Agency (JTC^3A) at Fort Monmouth, NJ. After having briefed ion the employment of prototype Maneuver Control System (MCS) equipment in Central Army Group (CENTAG), General Glenn K. Otis, CINCUSAREUR made the following statement:

> There is another one on the drawing boards, and hopefully we'll have it in the future, and that's the Position Locating and Reporting System and perhaps its ally the PLRS/JTIDS Hybrid. We need that system.
>
> As a matter of fact, on a Reforger [Return of Forces to Germany] exercise last year, we had a prototype PLRS System come over with one of the deploying divisions, and it worked great. As a matter of fact, on the drawing board you can't even begin to imagine, the uses. You have to get it out in the hands of troops and them employ it in the tactical arena. We found great use for this system. Now, if that use is going to be United States only, and we are not going to fight any United States only wars [i.e. coalition warfare], then we have to be careful about this conference is all about, achieving joint tatical command, control and communications interoperability.[44] [italics added]

FACTORS WHICH BODE ILL FOR THE FFW REQUIREMENT

o CONCEPT BASED REQUIREMENT SYSTEM (CBRS): Since its inception, the CBRS has produced forty-eight TRADOC 525-series Pamphlets, beginning with 525-1; US Army Operational Concept-Army Tactical Intelligence Concept (ATDO) in June 1980 to the most recent (December 1985), 525-48: US Army Operational Concept for Logistics Support in a Nuclear, Biological, and Chemical (NBC) Environment. With the Army's Current "umbrella" concept being the AirLand Battle, and inculcated in the doctrinal Field Manual 100-5: Operations, truly CBRS is refocusing

> the [force] development direction of past decades from a materiel-oriented flow to a concept-based flow. In other words, the Army starts with a concept of how-to-fight, then acts to modernize the force with requirements derived from the how-to-fight concept."[45]

In the case of Close Air Support (CAS) the lessons-learned from World War II and Korea have not resulted in the development of an operational concept as an end-product of the Mission Area Analysis (MAA)

process. Without this systematic identification of deficiencies in present training, organization, doctrine or materiel capabilities, the FFW requirement will never have the necessary commitment (advocacy) with the RDA or budgetary process. We have already discussed in Chapter Two the human behavioral aspects (i.e. cognitive dissonance) involved in effecting institutional change, and touched briefly on what constitutues parochialism. The issue of CAS is the Air Force and Navy at odds over the technical approach to C^3I design of JTIDS, But, within the four Services there are pockets of resistance centered around the age old question,

> What has the greatest tank-killing potential, the tank, the helicopter, the antitank weapon (ground mounted), the 'fast-mover' (aircraft), etc., etc., adnauseam?"

Let us settle this argument by stating simply that there will be enough enemy armor for everyone. All Services and Army branches of service are welcome to the First Battle where we will all be fighting out-numbered and trying to survive. Professional discourse and disagreement is healthy, particularly in a period of strategy transition. But, we must be aware that while MG Sam Damons and BG Ben Krislers take on the LTG Massengales[46] in intellectual jousting contest, serious consequences can result. You only need to remember the tragedy of Hill 282 on 23 September 1950, to put the problem of friendly force recognition/identification into proper perspective.[47]

o SERVICE JOINTNESS: Lt. Col. David Evans, USMC, makes a valid argument for the Navy/Marine Corps forcible/entry capabilities in an immature theater area of responsibility (AOR).[48] But, when he and

others like him who argue that the Army and Air Force don't have a rapid deployment mission without significant forward basing of ground tactical air forces their parochialism begins to reveal itself. Rather than viewing these opposing arguments from a negative standpoint (which would only exacerbate the situation and further delay reform), inter-Service rivalry can serve a useful function by grading the various faction into developing an even better threat-oriented, joint operational concept. As Colonel Thomas Cardwell, USAF, puts it

> . . .to make the AirLand Battle doctrine work, we must put aside our service bias and look at the doctrine from a joint perspective. . .[for] once we do that, we can address the real issues at hand -the coordination level [among all Services] and the synchronization of tactical air assets with the land maneuver.

Colonel Cardwell cites synchronization as the "integration of tactical air assets in the land component commander's maneuver scheme,"[49] and includes not only close air support (CAS), battlefield air interdiction (BAI), but also air assets as represented by the TR1 (Joint STARS: Joint Surveillance and Target Attack Radar system), and the Joint Tactical Missile system. As he summarizes:

> Until we put aside individual service biases, we will never make the system work. Until we approach the problem from a joint perspective, we will never make the [ALB] doctrine work - and will be arguing about it forever. . .[where we] have come up with a method [e.g. operational concept: 525-series pamphlet] to effectively employ tactical assets on the modern battlefield. . .it must be tested, and improvements must be based upon these tests [exercises].[50] [italics added]

But, Service "jointness" won't come easy. The following two examples, illustrate the magnitude of the problem at both the materiel development (e.g. JTIDS) and concept (e.g. air-ground procedures) development levels. You will recall the description of JTIDS as contained in the OSD Annual Report To The Congress.[51] One would gather, from reading the Air force and Army descriptions of their programs, that all is well in the Tri-Service arena with the JTIDS technology. But that is not the complete picture. After years of wrangling with the Navy in their pursuit of a JTIDS technique called Distributed Time Division Multiple Access (DTDMA), while the Air Force used another technique (TDMA: Time Division Multiple Access), it appears that Congressional pressure finally was used to bring the Services in line. As a Wall Street Journal article reports:

> The Navy dropped plans to build a tactical warfare communications system being developed by ITT Corp. and Hughes Aircraft co.
>
> Instead, the Navy will work with the Air Force and Army to build a model being developed by Singer Co. and Rockwell International Corp.
>
> The decision comes after the Navy has spent about $100 million on developing the ITT-Hughes system, known as the Joint Tactical Information Distribution System. . .
>
> Cancellation of the Navy's system comes amid criticism that the services, particularly the Navy, seldom coordinate their procurement, causing wasteful overlaps in weapons programs. A staff study under consideration in the Senate Armed Services Committee contends that the individual military services have too much power in the procurement process. . ..
>
> In Fullerton, Calif., a Hughes spokesman conceded that the Navy's system faced some "technological hurdles" and that a restructuring of the program had caused delays in development. He noted that consequently the program hadn't yet gotten out of the [demonstration and validation] development stage, and "Congress wanted to go with a system that was operational."[52]

The three-day war in the Caribbean in October 1983 revealed several shortfalls in Joint Operations. The full story of the Grenada (URGENT FURY) operation are only now coming to light in an unclassified format.[53] Colonel Dave Starling, XVIII Airborne Corps Corps Support command (COSCOM) Commander is quoted as saying:

> . . .the Army, "in general " did not understand how Navy tactical aircraft operated. One [Navy commander] said the army was unfamiliar with the weapons commonly carried on the A-7 corsair, the aircraft that performed the bulk of close-air support during the operation. Army personnel charged with identifying targets for pilots were not able to clearly do so, either because of different maps or misunderstandings.
>
> .....
>
> A variety of. . initiatives . .are underway because of the Grenada experience. An important step was taken when Army Chief of Staff, Gen. John Wickham, Jr., and Air Force counterpart, Gen. Charles Gabriel, signed a 31-point memorandum outlining ways to cooperate better in budgeting and operations. Several of the initiatives began with carbon copies of complaints lodged against interservice mixups in Grenada. Project officers working on the 31-point memorandum say they are also studying ways to <u>get the services to use the same radio frequency.</u> But not all these efforts have been successful yet, and some observers doubt that they ever will be. Contributing to such skepticism is the fact that the Navy is participating only minimally in the project.[54] [italics, mine]

o <u>COALITION STRATEGY</u>: Limited resources and historical precedent indicate that any future confrontation with the Communist Bloc will be executed in concert with one of more Allied nations. Yet with this fundamental "truism" guiding our National Security Policy and military strategy, we have utterly confused our closest Allies in Europe as to our intentions in the use of Close Air Support. When Supreme Headquarters, Allied Powers, Europe (SHAPE) addresses the concept of Follow-On Force Attack (FOFA), it is not alone in its concern "with

interdicting fixed targets such as key transhipment points or other installations that affect Soviet capabilities to bring its strategic reserves to bear."[55] It appears that SHAPE's FOFA concept is abetted in the United States. Writing in the September-October 1985 issue of Infantry, LTC Ronald D. Offley, USAF, himself a CAS pilot with Vietnam experience poses a rhetorical question and answers it this way:

> Will close air support be available on the first day any future conflict?
>
> In a September 1984 article, Assistant Secretary of the Air Force, Tidal W. McCoy established the Air Forces's mission priorities the way: "Air superiority is the first mission, because we believe that without control of the air, neither we [the Air Force] not the ground forces can succeed. In effect, we now must perform counter air, superiority, deep interdiction, and battlefield interdiction at the same time. Thus, we are structuring our forces accordingly. We have not, however, elected to pursue air superiority at the expense of all others. The A-10s, A-7s, F-4s, and F-16s in their air-to-ground modes are very capable CAS aircraft.[56] [italics added for emphasis]

Coupled with the Army's lack of countervailing MAA-based proposed solutions to the tactical air controversy, and lack of Service "jointness" by Joint Chiefs of Staff (JCS) charter, the Air Force will hold sway in this matter. JCS Publication 2: Unified Action Armed Forces (UNAFF), dated 1 December 1975 contains the following paragraph 20408; titled: "Air Force Responsibilities in Connection with Close air Support (CAS) of Ground Forces."

> . . .c. Developing, in coordination with the other Services, doctrines and procedures for close air support of ground forces. . ..
>
> d. Developing equipment, tactics, and techniques employed by Air Force forces in close combat air support of ground forces.[57]

But a balanced approach to the tactical air doctrine issue appears to be emerging. Since Mr. McCoy's statement in September 1984, the 31-

point Memorandum of Agreement (MOA) between the Service Chiefs of the Army and Air Force has been expanded with Initiative #33: Future Close Air Support (CAS) and directs the formulation of a CAS working group (CASWG) composed of the Tactical Air Command (TAC) and Army's TRADOC. Ostensibly formed for the review of the CAS system in the summer of 1985, the CASWG was charged to jointly address the possible replacement aircraft for those now performing the CAS mission role. This positive sign is further reinforced by two materiel development-related activities that illustrate the USAF's commitment to the ground forces support role. The first has to do with low altitude navigation and targeting, which would "provide the capability for the F-15E and F-16 aircraft to enter and leave the target area below enemy air defenses at night and in conditions of limited visibility."[59] The system under testing is the LANTIRN (Low altitude Navigation and Targeting Infrared System for Night). Understandably, the USAF wants to mount the LANTIRN pod on its "high performance" air frames to insure their survivability and availability in all weather conditions. If the question of friendly troop survivability is an issue, it is the responsibility of the Army to insist that the same capability is made available to CAS aircraft as well. In this regard:

> the Air Force has conducted extensive analysis and actual testing of various systems to perform the single-seat night attack mission. More, specifically, the Air Force conducted extensive testing on an A-10 test-bed at Edwards AFB during 1983 for the purpose of evaluating configuration combinations in night attack....The LANTIRN system was found to be the most cost-effective single alternative across all mission areas.[59]

Around the clock fire support of ground forces can be accomplished by other means than just artillery and tank-gun fire. Former Secretary

of the Air Force, the Honorable Verne Orr, believes this also. Before his retirement in late-1985, he was interviewed by the Armed Forces Journal. Here is an extract from that candid interview, in which he is laying out the priorities for his successors in the Secretariat.

> I held up the RFP [request for proposal] for the advanced fighter for a while, and I make no bones about why I did it. I want to keep the Air Force in balance. And I felt we were going farther ahead of our [joint] interest in air-to-air combat than in the part of our mission which says we have got to support the ground troops with close air support.
>
> . . .The old days of fixed trench warfare, in which you had an A-10, or something that goes up and down, are over. In the AirLand Battle 2000 [Army 21], it is a more fluid front. Maybe we're 50 klicks [kilometers] behind the enemy line with some of our forces, and they may be 50 klicks behind our line [i.e. rear operations] with some of theirs. And we will need a plane that will take care of itself and get out of trouble much faster that the A-10. . .<u>It's got to be a decision the Army is comfortable with</u>.
>
> [Question by Armed Forces Journal] Have you completely rejected a modification to the A-10 or the future close air support role?
>
> At the moment, that has never been a player. I've not had anybody come to me and say, "We ought to modify the A-10."
>
> [Question] We thought that the Army loved the A-10.
>
> Well, the Army may love the A-10. If I were an Army man, I'd love anything the Air Force says is specifically designed for my mission. And anything that has a dual purposes, I'd worry about. . .. [With regard to the A-10, Thunderbolt II] they know it's theirs. There is <u>no place else it's going to be but protecting the troops</u>, basically.[60]
>
> [italics added for emphasis]

CONCLUSIONS

This Chapter highlighted a C^3I hardware requirement. If recognized by the Army's Force Development process as a viable materiel need to support AirLand Battle doctrine and at the same time enhance troop-safety of close air Support (CAS), then perhaps someday CAS

aircraft will be equipped with a Friendly Forces Warning (FFW) capability. Together with other emerging technologies which will give strike aircraft an all-weather, round-the-clock capability, the challenge is to make CAS as responsive to the front-line ground commander's needs as possible. The Joint Tactical Information Distribution System (JTIDS) technology developed by the Air Force in concert with the other Services has been proven operationally ready through its support role onboard E-3A (AWACS) aircraft. The voice and data capability of JTIDS provides the necessary control, navigation, identification, and reporting functions for synchronizing tactical air operations and meeting the challenge of the complexity involved in coalition warfare. As more experience is gained with this state-of-the-art technology, the greater will be the opportunity to shift from a 24-hour planning cycle for CAS and Battlefield Air Interdiction (BAI) missions at the tactical and operational art of warfare (i.e. Corps) levels.

An ally of JTIDS, is the Army and Marine corps' Position Location Reporting System (PLRS). Based on its successful employment as a prototype system during REFORGER exercises, General Glenn K. Otis, CINCUSAREUR, has given PLRS and its follow-on capability, the PLRS/JTIDS Hybrid, his personal endorsement. But will the PLRS and/or the Hybrid (PJH) capabilities suffer the same fate as Project MALLARD in the late-1960's for lack of concept development community advocacy? For illustration purposes in this Chapter, we assigned the US Army signal Center proponent responsibility for conducting the necessary Mission Area Analysis (MAA) functions required under Training and Doctrine Command's (TRADOC's) Concept Based Requirement System (CBRS). But, the

question remains, when employing a C^3I technology to a fire support application like the Tactical Air Support mission, is the Signal Center in the best position for guiding the concept development?

A strong case can be made for designating the US Army Field Artillery Center, Fort Sill, OK as the proponent agent for insuring the proper integration of Tactical Air Support into the high-speed data communications system servicing the Corps area of operations. CAS, like field artillery, has a troop-safety consideration for the delivery of ordnance. CAS, like field artillery, has a requirement to pass message traffic which lends itself to Digital Message Entry Device (DMED), burst-type transmission. Enemy Radioelectronic Combat (REC) capabilities augur-ill for lengthy voice messages that deal with target descriptions, friendly locations, start points, heading and distance to target information, abort codes, etc.

Together with the Mobile Subscriber Grid System (MSGS) discussed in the last chapter, the PJH represents the type of distributed communications network for handling (high throughout) digital subscriber traffic on the AirLand Battlefield. In particular, the Class II terminals of PJH are specifically designed to interface (interoperate) with the Tactical Fire Direction System (TACFIRE), a computer-based system not unlike the one needed by the Air Support Operations Center (ASOC) collocated with the Corps Tactical Operations Center (CTOC). The large-scale, integrated, fire direction capability of TACFIRE mirrors the ASOC's mission for assimilating large volumes of data and continuously coordinating the planning and execution of close air support for ground forces.

The Army's Command & Control Master Plan (AC^2MP) for insuring C^3I interoperability among all digital (and analog) subscribers will be undergoing Continuous Comprehensive Evaluation (C^2E) during scheduled formal Development Testing (DT) and Operational Testing (OT). As new generation automated fire control systems like the Advanced Field Artillery Tactical Data System (AFATDS) and emerging computer-based tactical air support systems reach their life-cycle testing phase, C^2E would be greatly facilitated by having one of the major players in the SIGMA-Star architecture assume MAA responsibility for air-ground operations. The field artillery's mission is the closest parallel to tactical air support of any of the other SIGMA-Star components (i.e. maneuver, air defense artillery, intelligence/EW, or combat service support).

In the past, split responsibility for air-ground operations and a lack of coordination among fire support means has resulted in a 13-year lapse since the last publication of doctrine. Field Manual 100-26: The Air-Ground Operations System was last updated in March 1973, and reflects an operational concept for airspace control that doesn't adequately address coalition warfare, interoperability, or recognize the emergence of C^3I and battlefield automation technologies. The lag in doctrinal development and the MAA proponency issue should be considered for thorough research through the Army's Advanced Military Studies Program (AMSP), Fort Leavenworth, KS.

ENDNOTES

1. Rear Admiral Henry E. Eccles, Military Concepts and Philosophy, (Rutgers University Press, 1965), p. 22.

2. George C. Wilson, "Military Reform," Washington Post, October 15, 1985.

3. Keith A. Dunn and William O. Staudenmaier, Alternative Military Strategies For The Future, (Carlisle Barracks: US Army War College, 1 March 1985), p. xiii. Ambasador Komer's remarks in the Foreword are appropriate in highlighting the interrivalry problem: "the fact is that the United States does not have even a unified strategy... instead, we have four separate Service strategies, loosely cobbled together by the JCS. . ." In the same work, Jeffery Record, "Third World conflicts: Implications for US Security and Force Structure," concludes that the Rapid Deployment Joint Task force (RDJTF) of US Readiness command and "its successor USCENTCOM are the products less of impartial military judgement than they are of the bureaucratic desire of each Service for at least a 'fair share' of the rapid deployment mission." Mr. Record bases his argument for a Marine Corps forcible-entry mission in Southwest Asis (SWA) on the fact that:

> . . .unlike the Army, which must rely on another Service for tactical air support, the Corps has its own air arm, not only compatible with carriers and other sea-based air platforms, but also highly integrated with both carrier-based naval aviation and Marine ground forces. In short, in contrast to the Army - the Corps' principal competitor for bureaucratic control of the rapid deployment mission - the Marine Corps is fully compatible with sea power: the necessary foundation of a US Military presence in those Third World areas where US Forces are not stationed ashore. [pp. 173-174.]

4. David Evans, "The Ten Commandments of Defense Spending," The Washingtonian, October 1985, p. 119. Lt. Col. Evans is currently the Operations Officer of the 3rd Marine Division. He previously served on the OSD staff as director of manpower planning and analysis.

5. Colonel Thomas A. Cardwell III, USAF,, "Follow-On Forces Attack: Joint Interdiction by Another Name," Military Review, February 1986, p. 10. Colonel Cardwell is a graduate of the Air War College and currently is the commander of the 601st Tactical Control Wing, Sembach Air Base, W. Germany.

6. Ibid.

7. Dunn and Staudenmaier.

8. Michael Weisskopf, "Infantry Still Can't Kill Tanks," Washington Post, January 13, 1986, p. A1.

9. Like the TRI-TAC Program, the Joint Tactical Information Distribution System (JTIDS) represents technology that is well in hand. The Air Force R&D efforts stemming from the early 1970's absorbed the

bulk of the technological risk associated with the development. With the Air Force as the program-leader for JTIDS, it is described as follows in the OSD Annual Report to the Congress for FY 1986: [JTIDS is] a secure, jam-resistant, digital data and voice system designed for use by all Services. The United Kingdom also plans to purchase JTIDS equipment for some of its tactical air forces. The system is now deployed on E-3A (AWACS) [Airborne Warning and Control System] aircraft in Europe and will be deployed in US systems later next year.

> The enhanced JTIDS system (EJS) will satisfy our requirement for a secure, jam-resistant voice radio for our tactical aircraft. As a near-term response to the soviet jamming threat, we are modifying our tactical UHF [Ultra-high frequency] radios with the HAVE QUICK system.
>
> The Air Force, with participation by the Army and Navy, is also developing combat identification sytem for use by the Services and our nation allies. As suggested above, we are pursuing a program to integrate voice, data, and identification [IFF: Identification, Friend or Foe] systems into a common, modular design. [italics added]

The following is a description of the Army's Position Location Reporting System/Joint Tactical Information Distribution System (PLRS/JTIDS Hybrid), as extracted from the OMEGA Study, "Objective Divsion Communications Architecture," (Fort Gordon: US Army Signal Center, 3 Septermber 1982), p. 2-12. (The reader will note the contrast between the Air Force's reliance on the technology for reporting and identification, and the Army's requirement for position location and navigation).

> PLRS/JRIDS Hybrid is the objective division area data communictations system that will provide position location, identification, reporting and navigation information to selected users. The PLRS/JTIDS Hybrid is an adaptation of the PLRS and JTIDS programs for the Army's data transmission needs. PLRS is a joint program with the Marine Corps and JTIDS is a joint program with the Air Force, Navy and Marine Corps. . ..
> [Specific capabilites are:]
>
> Electronic Counter Counter Measures (ECCM). To counter the threat of the 1980-1990 timeframe, which will employ electronic countermeasures (ECM) and signal intercept activities, the (PJH) is designed to use state of the art techniques. . .[such as] pseudo-noise spread spectrum and frequency hopping ECM techniques.

Position Location, Identification and Reporting. The (PJH) satisfies the need to provide accurate and near real-time positioning and navigation information to insure the effectiveness of combat, combate support, and combat service support elements on the battlefield. This capability is essential to insure the effective control of maneuver elements [i.e. MCS: Maneuver Control System] and the coordinated employment of both fire and air support in a tactical environment while operating under all conditions of visibility, weather, terrain, and during night operations.

Joint Interoperability. JTIDS will satisfy the need to provide innteroperability between the other services and NATO's battlefield automated systems. A joint message standard, TADIL (Tactical Digital Information Link) J will be used to exchange this information between these selected systems. At the present interoperability is limited to LOS [line of sight] multichannel systems and manual liaision officer exchanges.

10. Lt. Col. John W. Braden Jr., USA, and Maj. V. Paul Baerman, USA, "The TOC: Backbone of Command Control," Military Review, November 1981, p. 41. Much of the author's concerns with command post (CP) survivability can be overcome with a "distributed C^3I" system like PLRS/JTIDS Hybrid. Because of its "nodeless" characteristic, where every electronic emitter acts as a relay for others in the matrix, the identity of each station is protected.

11. Cpt. Lonnie O. Ratley III, USAF, "Air Power at Kursk: A Lesson For today?" Military Review, April 1978, p. 59.

12. Ibid.

13. Ibid., p. 61.

14. L. James Binder, "The War is Never Over At Fort in the Mojave," Army, April 1983, p. 30. An excellent article detailing the training benefits from the NTC. Another article highlighting C^2 requirements is by Maj. Harvey A. Testen, Jr., "Command and Confusion at the NTC, "Military Review, November 1985, p. 56. A summary of NTC training observations, Letter (OFOP-TAU), US Army Forces Command, dated May 26, 1982 directs attention to the use of Close Air Support (CAS) as a fire support measure. Annex E (Fire Support Trends) states:". . although knowledge of CAS request procedures is important, the detailed planning and coordination considerations mentioned are the key to effective and successful CAS. It is obvious that home station training in this aspect of fire support is largely neglected." [italics added]

15. US Readiness Command (USREDCOM) Pamphlet 525-8/TRADOC Pam 525-45/Tactical Air Command Pamphlet (TACT) 50-29, General Operating Procedures for Joint Attack of the Second Echelon (J-SAK), (Fort Monroe: US Army Training and Doctrine Command, December 31, 1984), p. 42.

16. Lt. Col George F. Kolesar, USA, "The Architecture Goal: Systems That 'Talk'," Army, July 1985, p. 36.

17. Ibid.

18. Gen. William E. Depuy, USA (ret.), "Toward A Balance Doctrine: The Case for Synchronization," Army, November 1984, pp. 20 and 23.

19. Ibid. Air Force officers recognize the problem of air-ground synchronization and the fact that "success on the battlefield requires that every one fight together." Colonel Albert J. Edmonds, USAF, "Information Challenges From Tactical Air Operations," Signal, November 1985, p. 71. Colonel Edmonds believes together with other military professionals that ". . .warfighting success may depend on how well we move information to support the flying." An example of how sluggish our C3I systmens are at present was demonstrated during the Joint Readiness Exercise (JRX) GALLANT KNIGHT 86, at Fort Bragg NC. The requirement for a better C^3I data distribution network, a digital message entry capability employing preformatted messages, and a transportable battlefield automation system akin to the Tactical Fire Direction System (TACFIRE) to support Tactical Air Operations is no more evident that during a JRX. Writing from his experiences during GALLANT KNIGHT 86, Maj. Sam Lambert, USA, XVIII Airborne Corps, Office of the Assistant Chief of Staff Communications-Electronics states:

> . . .Both preplanned CAS &BAI [Battlefield Air Interdiction] originate at the Battalion level [and] are consolidated and prioritized at Brigade and Division. At the Corps level, CAS is again prioritized and forwarded. BAI targets are segregated by the Fire Suppport Element [FSE] and the ones that are within Corps' capability are targeted and the ones that are not are prioritized and forwarded. The ultimate destination of this request is the Air Force TACC [Tactical Air Control Center at the Air Component Commander's headquarters]. In some cases there is a EAC [Echelon Above Corps] Army unit [e.g. BCE: Battlefield Coordination Element] involved; in some cases not.
>
> The TACC includes these with other missions and produces an Air Tasking Order [ATO] which is distributed to all concerned as feedback for which requested targets are actually targetted. This is a big message, 20-30 sections and up to 100 pages which contains all air missions for that day.

> During GK 86 at the Corps [level] we never received all sections of the ATO - I am sure the Divisions were the same [as were] the Brigades and Battalions. In any event, the feedback was not received prior to the time when the next day's request was due. Additionally, the Bomb Damage Assessment was not received/or [not] received in a timely enough manner to allow it to be factored into the next day's preplanned missions. The point is with the systems we have for critical items we cannot turn around in our own decision cycle much less get inside [that] of the enemy's.

Maj. Lambert recently authored an article on his experiences as a C-E Staff Officer to the 525th MI Group during its deployment to Grenada (Operation URGENT FURY) in October 1983. Maj. Sam Lambert, "Command And Signal," Military Intelligence, January-March 1985, pp. 21-22.

20. LITE 86, Map Exercise Arabia, Academic Year 1986, (Carlisle Barracks: US Army college, January 1986), pp. 62-67.

21. Ibid., p. 43.

22. The reader is reminded to recall the experience of the Scottish Highlander "Argyll" Battalion during the Korena War. As described in Chapter One, the Argylls employed panel markers for recognition/identification during a Close Air Support (CAS) mission with disastrous results.

23. Lt. Col. Ron Offley, USAF, "Close Air Support For The AirLand Battle," Infantry, Sept-Oct. 1985. p. 23.

24. Edwin J. Elmore III, "Soviet Doctrine Stresses Electronic Warfare," Air Defense Artillery, Winter 1985.

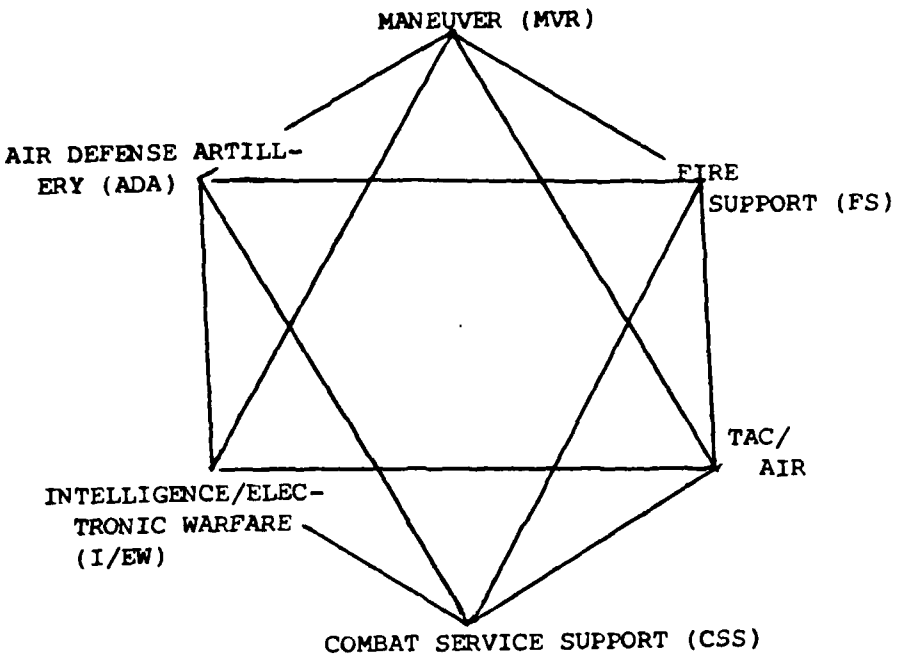
25. Offley, p. 22.

26. Ibid.

27. Gen. DePuy, p. 21.

28. New Collegiate Dictionary, (Springfield: G&C Merriam Co., 1977), p. 1173.

29. Gen. DePuy, p. 21.What General Depuy is proposing can be illustrated by using the SIGMA-Star conceptual model. But, whereas the model in Chapter Two consisted of a five-pointed star, the DePuy "model" has an added star point labeled: Tactical Air Control System, as depicted below:



30. Colonel Norman E. Wells, "Joint tactical Information Distribution System (JTIDS)," Signal, March 1982, p. 11.

31. Ibid., p. 13.

32. PLRS/JTIDS Hybrid Brochure, (Fullerton California: Communications Systems Division, Hughes Aircraft Co.).

33. Ibid, p. 7.

34. Weisskopf.

35. Army Command and Management, (Carlislee barracks: US Army war College, 19 August 1985) p. 12-1.

36. Ibid., p. 112-3. the following list was extracted:

MISSION AREA	PROPONENT
Close Combat (Heavy)	US Army Armor Center, Ft Knox, KY
Close Combat (Light)	US Army Infantry Center, Ft Benning GA
Aviation	US Army Aviation Center, Ft Rucker, Al
Air Defense	US Army Air Defense Center, Ft Bliss, TX
Combat Support, Eng. & Mine Warfare	US Army Engineer Center, Ft Belvior, VA
Combat Service Support	US Army Logistics Center, Ft Lee, VA
Fire Support	US Army Field Artillery Center, FT Sill, OK
Battlefield Theater Nuclear Warfare	US Army Combined Arms Center, Ft. Leavenworth, KS
Nuclear, Biological, Chemical	US Army Chemical School, Ft. McClellan, AL
Command & Control	US Army Combined arms Center, Ft. Leavenworth, KS
Communications (Automation)	US Army Signal Center, Ft Gordon, GA
Intelligence & Electronic Warfare	US Intelligence Center, Ft. Huachuca, AZ
Special Operating Forces	US Army Institute of Military Assistance Ft. Bragg, NC

37. Ibid., pp. 12-1 to 12-2.

38. Ibid., p. 12-3.

39. The acronym MANPRINT stands for Manpower and Personnel Integration. A recent article by Colonel Warner D. Stanley III, USA, "MANPRINT: The Leverage for Excellence," Army Research, Development & Acquistion Magazine, March-April 1985, p. 5-7, detailed the Army's growing concern that "in the world of high technology and complex hardware, if MANPRINT concernations aren't addressed, we are likely to develop equipment that outstrips the abilities of our soldiers. [As TACFIRE and TRI-TAC illustrate] failure to pay heed to these people-quality demands is likely to yield high-tech systems requiring a level of soldier quality too costly to obtain for operating, maintaining, or repairing." Lt. Col. Evans, p. 120, brings to our attention the cost of ownership of high-tech systmes as they relate to formal training, sustainment training, training simulators, refresher training, ect. when he states:

> In the search for longer range, greater speed, and more accuracy, costs have skyrocketed. We have therefore been forced to buy less. Not to worry,

goes the claim; the new weaons are costly because they're effective. It is technology, not numbers -machines, not men - that make us strong. One wonders. At the National Training Center, the Army is firing prodigious quantities of the latest gun and missile munitions to achieve relatively few kills. Weapons common to more than one service [Lt. Col. Evans is a USMC officer] are yielding marked differences in effeciveness, suggesting that training in their use - in other words, the man behind the gun - remains paramont. [italics added]

40. Jim Tice, "MANPRINT Attracts Attention From Congress," Army Times, February 3, 1986, p. 46. [When responding to Congressional inquiry, General Maxwell R. Thurman, Army Vice Chief of Staff cited man/machine "deficiencies with the Dragon antitank missile. . .referring to problems with the design and training strategy. . .[with which] the Army has had only marginal success in attempting to counter deficiencies of the weapon with special training programs and training devices."]

41. Lt. Col. Charles J. Borns, "Continuous Comprehensive Evaluation," Army Research, Development & Acquistion Magazine, May-June 1985, p. 8.

42. Army Reguation 70-15, Product Improvement of Materiel, (Washington, DC: Department of the Army, Jue 15, 1980). This regulation details how product improvement (PI) can be made to extend the life or improve the performance of existing materiel "rather than acquiring or developing entirely new equipment." Preplanned Product Improvement (P^3I) is a planning consideration early in the life of a developent program. As detailed in a memorandum, Deputy Secretary of Defense, Subject: Improving the Acquisition Process, dated, April 30, 1981:

> A revolutionary system development approach which uses new and untried technology to meet a military threat can offer dramatic potential payoffs, but frequently ends up with large cost increases and schedule slippages.
>
> A evolutionary approach offers an alternative which minimizes technological risk, and consciously inserts advance technology through planned upgrades of those deployed subsystems which offer the greatest benefits. In this manner the lead time to field technological advances can be shortened while an aggressive scheduling of fielded performance [e.g. M1A1 with 120mm main tank gun] improvements can be expected during the service life of the systems. [italics added]

43. DARCOM Pamphlet 70-2/TRADOC Pamphlet 70-2, Materiel Acquistion Handbook, (Fort Monroe: US Army Training and Doctrine Command, January 20, 1984).

44. General Glenn K. Otis, USA, "Where It Has Worked," Published Minutes for August 1985 JTC3A conference held at Fort Monmouth, NJ, p. A-30.

45. Army Command and Management, p. 12-1.

46. Maj. Gen. Sam Damon and Brig. Gen. Ben Kisler are pseudonyms used in the article: "Army of Excellence? A Time to Take Stock," Armed Forces Journal International, May 1985. As the forward to the article explains:

> [these pseudonyms are] for officers who both served two tours in Vietnam commanding light and heavy US forces. . .Damon was the World War I Medal of Honor winner from the novel, Once An Eagle; Krisler, his assistant when Damon commanded a division, was later killed because of the stupidity of a three-star officer, Massingale, who rose through the ranks in staff duties, not command. The Massengales of today's Army worry Damon and Krisler greatly and vice versa.

47. Scottish Highlander "Argyll" Battalion.

48. David Evans, p. 21. Lt. Col. Evans makes the following statement in his otherwise analytical and straightforward article:

> The Marine Corps is designed for quick smash-and-grab operations seizing footholds on hostile shores. Its divisions are relatively light, and raw assault power makes up for limited staying power.
>
> The Army, organized around heavy divisions, was designed to win protracted campaigns. But in recent years the Army decided that it wanted a piece of the action in low-intensity wars and began creating light divisions. [italics added]

NOTE:
Lt. Col. Evans forgets that Vietnam was considered a low-intensity conflict (LIC) for which many Army divisions were ideally structured to prosecute.

49. Colonel Thomas A. Cardwell III, USAF, "AirLand Battle Revisited," Military Review, September 1985, p. 10. Colonel Cardwell was cited early from his February 1986 article, "Follow-On Forces Attack: Joint Interdiction by Another Name."

50. Ibid., p. 12.

51. Caspar W. Weinberger, Annual report to the Congress: Fiscal Year 1986, Washington DC: US Government Printing Office, February 4, 1985), p. 150 (Army's Data Distribution System (ADDS)), and 188 (Air Forces' JTIDS).

52. Tim Carrington, "Navy Cancels Plans to Build Data System," Wall Street Journal, October 22, 1985, p. 2. A follow-on article in the Washington Post, "Navy Scraps Communication System," October 23, 1985, p. A4 states that: "cancellation of JTIDS would save an estimated $27 million in the current fiscal year, according to the Navy.

53. Richard Halloran, "Miilitary's Message System Is Overloaded, Officers Say," New York Times, November 24, 1985, as quoted in Application of Power: Theater Forces, Vol II, (Carlisle Barracks: US army War College, January 15, 1985), pp. 146-147. The article states that: "poor communications among the fores invading Grenada [Operation URGENT FURY] 2 years ago hampered the operation, officials have said. A report written at the Atlantic Command [LANTCOM] in Norfolk, VA., on lessons learned in the invasion had 10 pages on communications, all censored and not made public.

54. Michael Duffy, "Grenada: Rampant Confusion," Military Losistics Forum, July-August 1985, p. 21.

55. Dunn annd Staudenmaier, p. 5. In explaining the difference between AirLand Battle doctrine and the SACEUR Follow-On Force Attack (FOFA) concept of operations, the authors state that:

> The SACEUR plan calls for more preplanned air strikes. . .(whereas) Airland Battle requires decentralization so air assets will be responsive to Corps commanders. . .
>
> [Also], different technologies and acquistion policies will be needed for each concept. To be successful, both AirLand Battle and Follow-On Force Attack require that military commander have the capability to acquire and strike targets beyond the immediate battlefield. The primary difference between these two approaches, however, is the depth to which the Corps commander needs to acquire and attack Soviet targets. AirLand Battle is dependent upon acquiring targets up to 150-200 kilometers from the forward edge of the battle area [FEBA], while SACEUR's concept necessitates acquiring and striking targets much deeper into Warsaw Pact territory. . . [italics added]

NOTE:
The 150-200 kilometer zone equates to the Corps' area of influence, and is generally regarded as a 72-hour window for launching Battlefield Air Interdiction (BAI) strikes beyond the Fire Support Coordination Line (FSCL).

56. Lt. Co. Ron Offley, USAF, p. 22.

57. JCS Publication 2, Unified Action Armed Forces (UNAAF). (Washington, DC: US Government Printing Office, December 12, 1975), p. 19.

58. Air Force Issues Book, (Washington DC: Air Staff, Pentagon, Tele. (202) 695-0137 or AUTOVON 225-0137, May 1985), p. 86.

59. Ibid., p. 87. The Issues Book states that: "the systems included in the A-10 test were an imaging heads-up display [HUD], a terrain following radar, a fixed amaging infrared sensor, and a magnified imaging infrared sensor. . .[as well as] electronically scanning altimeters and modification of the existing F-16 radar were investigated."

60. Deborah Gallagher Meyer and Benjamin R. Schemmer, "An Exclusive AFJ Interview With: Verne Orr, Secretary of the Air Force," Armed Forces Journal International, November 1985, p. 46.

FINAL COMMENTS

> DOUGLAS MacARTHUR's CREDO: Every mistake in WAR is excusable except inactivity and a refusal to take risks.[1] [Italics added]
>
> Said by H.H. Frost
> Quoted in American Caesar

The more research that was performed to support this paper the clearer became the realization that all aspects of C^3I support of the AirLand Battle doctrine could not be adequately addressed in the confines of three chapters. For example, the fourth "C" in the acronym C^4 could not be given its rightful emphasis in an additional chapter alone. The area referred to is: computer systems or more aptly described as battlefield automation in support of rapid decisionmaking at the tactical and operational levels of command. The importance of this mission area is expressed in the decision to assign the US Army Signal Center, Fort Gordon with the proponency for automation and communications. In January 1985, General Richardson, commanding General, TRADOC ratified an earlier proposal from LTG Vuono, then the CG, Combined Arms Center, Fort Leavenworth, recommending that Fort Gordon be the "Center for automation-communications for the US Army and TRADOC proponents."[2] In his January reply:

> . . .GEN Richardson responded . . .by commenting that "the term Automation Communications Proponency is too limiting, and does not describe the full scope of the proponency I want to exercise. You are my proponent and the TRADOC Czar for automation and communications. GEN Richardson then continued with specific areas and actions he wanted covered. [These included:] . . .the responsibility for ensuring that all battle field communications systems are compatible interoperable and designed to minimize data exchange requirements, [for] CAC has approved the establishment of SIGCEN engineering cells at the primary Army Command Control System

(ACCS) centers; i.e., CAC, the Logistics Center, Intelligence Center, Field Artillery Center, and Air Defense Center.[3] [italics added]

But even though we will defer the discussion of computer-based decision support systems (DSS), it is appropriate that we review what many published authors of the joint Services have been writing on for the past 10 or more years. These officers are those with the vision and wisdom to extract from their experience and research the lessons-learned from the shortcomings in command and control (C^2); to recognize the pitfalls from the overuse of the combat net radio, voice communications in general and lack of realistic training in SPETSNAZ, Radioelectronic Combat (REC) countermeasures, and command post (CP) survival; and, to persevere in their quest for change the use of C^3I and microprocessor technology on the battlefield. Their motivation: to get at the TRUTH in order to ensure success in combat or at the very least, deter an adversary from military aggression. As General Robert Gard charges us as military professionals:

> [We] must develop a greater understanding of the implications of the necessary limitations on the use of force in the nuclear era . . . Deterrence of war and the attainment of political objectives must be recognized as "victory" at even the lowest tactical level.[4]

Even before the publication of the 1982-version of Field Manual 100-5; Operations, military journal articles were espousing the potential advantages from the combat fundamentals of synchronization, agility, and depth. As General Douglas MacArthur learned from his experience in the Far East against the Japanese and North Koreans, the (operational level) maneuver of envelopment can have a devastating

impact on the mind of an enemy decisionmaker. Leon Festinger's Theory of cognitive Dissonance is at work here, for if the friendly force commander takes the risk of seizing the initiative, he forces the opposing commander to face "a rapidly changing situation as a result of our deep attack."[5] In a June 1981 Army article, General Richardson presented the user's requirement for "success in the deep battle: better and faster communications and battlefield automation to increase the speed and quality of assessment, decisionmaking, and transmittal of orders."[6] The concept is summarized as follows:

> The concept of deep attack . . .is to create this situation for every enemy commander:
> o He has been forced to deviate from his orders....
> o He has been faced with a rapidly changing situation as a result of our deep attack. The changes have been so fast and frequent that he has been unable to determine our intentions and unable to revise his plan.
> o His decision process has been repeatedly interrupted and reinitiated. Attack of his command and control system has multiplied his confusion....
> o Unknowlingly, he reaches the point chosen for the decisive blow. Friendly preparations have placed fire support, logistic and maneuver elements in position to finish him rapidly.[7]

General Richardson cites LTC D. Holder and MAJ Dennis Long as two officers who have had extensive experience in implementing the deep attack concept at the corps and division levels. A spin-off of this effort is the "Warrior Preparation Center" concept implemented by LTG John Galvin, Commanding General, VII Corps. In a joint Army and Air Force project in Europe, "this effort to train commanders and staffs in airland battle operations also affords a basis for refining cross-service procedures."[8] General Depuy, in his Army magazine article on "Toward A Balanced Doctrine: The Case for Synchronization," makes a

strong case for joint wargaming exercises in developing "the mechanisms and procedures for air-land cooperations at the corps level."[9] The writings of many junior and senior military men and civilians echo the same theme for field exercise fidelity in ultimately achieving that mix of structural organization and technology together with doctrine and training which will ensure the assimilation of FM 100-5 into every facet of the Army Force Development process.

The following is a compedium of writings of those advocating change toward a maneuver-oriented strategy of land warfare. The topics they address are those critical to alleviating current C^3I and battlefield automation deficiencies:

INFORMATION AND TECHNOLOGY EXPLOSION: Just as an enemy commander's will to fight (i.e., take risk) is diminished by the rapid pace of our initiatives, so too is the US Army reeling from the onslaught of new items of equipment being fielded in the inventory, but not necessarily assimilated in a coordinated force integration effort. MAJ Long, in his November 1981, Military Review article tells us that technology impacts on doctrine in equal measure as the concept-based user requirements spawn innovative ways of applying state-of-the-art technology.

> Today, computers and telecommunicatons together are reshaping our whole society in ways which will inevitably extend to the battlefield . . .In initial field experiments with facsimile equipment, "commanders changed their way of doing business--for the better to take advantage of this capability."
>
> [For example,] facsimile allowed commanders a faster way to communicate graphically [vice aurally] and symbolically. More particularly, it gave them the ability to convey effectively a wider range of complex ideas for tactical operations....
>
> In another example, the simulation of the Position Location and Reporting System (PLRS) in a war game environment led to a [innovative and] spontaneous realignment of a division staff....

> Consider the impact, then, on the full command and control concept of such current and near-term... [technologies] as microcomputers, teleconferencing, satellite communications, video discs and artificial intelligence (AI).
>
> We must conclude that it is simply not enough to evaluate how a technological advance will assist a combat commander in controlling his force in the execution of today's doctrine. Rather, we must evaluate how the total concept for winning is changed and then measure the enhancement, if any.[10] [italics added]

THE ROLE OF HUMAN FACTORS IN COMPUTER TECHNOLOGY: With the advent microelectronics, very high speed integrated circuits (VHSIC), and Artificial Intelligence (AI), microprocessor computers have not only become faster and "smarter," but more useful at the tactical level for supporting the decision making process. Whereas the more centralized, mechanized microcomputers in weapon systems (i.e., TACFIRE, Missile Minder, etc.) have played a vital role in gathering, processing and disseminating information, "the use of computers to support tactical operations, strategic planning and the projection and evaluation of alternative courses of action, have been far less successful and valuable than . . .the user has expected."[11]

H. Bennett Teates prescribes developing prototype decision support system (DSS), putting them in the hands of the user, evaluating their impact on command and control in order to overcome the shortcoming of previous systems where "very little use of human perception or judgement in an interactive symbiosis with automated processing"[12] has been attempted. Because of our lack of understanding of the human decisionmaking process, agencies such as the Army Research Institute for the Behavioral and Social Sciences (ARI) have made significant

contributions in training and operational systems. A recent article in RD&A magazine on AI shows the progress with existing high-technology weapon systems:

> The distributed battlefield of the future will . . .make unprecedented demands on the cognitive decision-make skills of its soldiers. They need to be prepared intellectually to make fast, appropriate decisions [e.g., Stinger gunner, HAWK maintainer, etc.] and use complex [troubleshooting, identification] strategies and technologies. The best way to train soldiers is to use the same smart technology they will use on the battlefield. At some point in the future, battlefield systems may even have intelligent training systems embedded in them.[13] [italics, added]

INNOVATION: NECESSITY IS THE MOTHER OF INVENTION: The Stuka dive-bomber, the gasoline powered tank, and the tactical radio gave the Germans the technology for implementing doctrinal changes in the late 1930's. As with the British testing of new operational concepts of mobile warfare on the Salisbury Plain, the Germans conducted trails "in Russia . . .[and] in the Spanish Civil War. And these closely observed lessons were fed back into the systems for the further refinement of their mobile striking force."[14] General Starry writing an article in Military Review, "To Change An Army," concludes that "changes proposed must be subject to trials [and] their relevance must be convincingly demonstrated to a wide audience by experimentation and experience, and necessary modifications must be made as a result of such trial outcomes."[15]

The step-by-step, evolutionary approach to force development and integration of new technology into the Army's inventory is a thesis which runs through the writings of many authors. Heavy involvement of the user is required both in the formulation of requirement (need)

statements and in the test and final acceptance of the new doctrine,, organization, training technique or equipment item. Author Sherman Gee has some insights for us military professionals who seek the best weapon and C^3I systems for our soldiers and the successful implementation of the AirLand Battle doctrine. The essence of Mr. Gee's thesis is:

> Technological change is the incremental improvement or progress made in the science-technology base, ... [it is the] incremental upgrading of the existing pool of knowledge and accepted practices in the technical field.
>
> Innovation is the process of taking an idea invention, or recognition of a ... need ... Innovation does not necessarily depend on technology ... [nor is R&D] a prominent source of new technological innovations. Evidence to date in fact suggests that R&D plays only a minor role in helping to stimulate new innovations.
>
> Numerous studies have been performed in order to increase our understanding of the innovation process . . .. A major conclusion drawn from the studies is that roughly three out of four successful innovations are stimulated from need recognition, while the remainder are initiated from the availability of technical opportunities. That is, demand-pull rather than technology-push is the more important stimulus in most cases of successful technological innovations.[16] [italics added]

REALISTIC TRAINING EXERCISES--A SPAWNING GROUND FOR INNOVATION:

The "Warrior Preparation Center" concept described earlier by General Depuy is the type of environment for stimulating innovative thinking. The National Training Center is another, although limited at present in area, and therefore not conducive to the evaluation of tactical (division) or tactical/operational (corps) integrated combined arms and support operational concepts. In the early 1970's the first of the division restructuring studies underwent field trail testing at Fort Hood, Texas. Since then the instrumentation and testing procedures have been fine tuned under the organizational auspices of the TRADOC Combined

Arms Test Activity (TCATA). And, now with the advent of the microcomputer power designed into battlefield simulation like the Army Training Battle Simulations system (ARTBASS), the 7 years of wargaming exercises conducted at Fort Leavenworth can be factored into the operational level of war.[17] Edward N. Luttwak, writing on the contrasting approaches to warfare represented by attrition and relational-maneuver characterizes the former as having the "great attractions of predictability and functional simplicity." Whereas the maneuver style has as its goal the incapacitation of "enemy forces or structures--and indeed the whole enemy entity...[and] instead of cumulative destruction, the desired process is systematic disruption...."[18] With such a style of warfare, the training preparation, R&D effort and indeed the whole thrust of the Army Force Development process should, in Mr. Luttwak's opinion, proceed as follows:

> o Examine in detail the relevant enemy forces and weapons.
> o Identify specific limitations and weaknesses.
> o Develop or modify equipment to obtain fine-tuning of capabilities against those forces and weapons.
> o Modify and develop incrementally to maintain a "good fit" as enemy forces also evolve. Since new items [innovation, P^3I, etc.] are introduced at short intervals, accept design constraints to ensure compatibility [i.e., interoperability, man/machine interface, etc.] (inter-equipment and also with supporting structures). No need to force advances on the state of the art.
> o Create a continuum between in-theater modifications and the central development process [i.e., TRADOC/Army Materiel Command].[19]

Several TRADOC Pamphlet 525-series operational concepts come to mind when considering the war preparation approach opined by Mr. Luttwak. The following will be an examination of a sampling of these concepts from a C^3I and battlefield automation perspective. If successfully subjected to the rigors of field trial testing, there

should be little problem in consensus (advocacy) building in the Army and Air Force, the hardening of doctrinal precepts in Field Manuals (i.e., Field Manual 11-92: Combat communications Within the Corps) and the stimulation of user requirements for new materiel or organizations generated by TRADOC's Concept Based Requirements System (CBRS). An environment of field testing set against the background of computer-assisted wargames and/or field training exercises (CPX/FTX) like the semiannual GOLDEN SABER Exercise at Fort Hood, cannot be replicated by the R&D laboratory in the Army Materiel Command. "Studies of successful innovations in both the military and civilian sectors reveal that research results initiated innovations in only about 5 percent of the case studies."[20] Rather than the laboratory technician who's motivation is "coupled with peer recognition," the soldier-innovator possesses the "qualities requiring a breadth of knowledge in different fields . . .[and] generally exhibits a high degree of creative ability . . ."[21] motivated by a desire to succeed and survive on an increasingly lethal battlefield.

TRADOC Pam 525-2 (Army Tactical Command and Control); Pam 525-39 (Automatic Switching); Pam 525-40 (System Manual for Employing TRI-TAC Equipment in Joint Communications Systems):

The III Corps, Fort Hood, is scheduled to be the first to receive the Mobile Subscriber Equipment (MSE). The Operational and Organization (O&O) Plan assumes that an area grid ("backbone") communications network will be established for "a 3 division corps force with build up to a 5 division corps force as the battle progresses."[22] In keeping with Mr. Luttwak's recommendations cited above, the MSE is "a non-developmental [item (NDI)] approach to procurement with heavy reliance on a preplanned product improvement (P^3I) approach to meet less than absolutely

essential required system capabilities."[23] The baseline requirements established in both the O&E Plan and the cited TRADOC Pamphlets were used to evaluate the French-built RITA and British-built PTARMIGAN "cellular radio-telephone" systems prior to selecting the GTE Government Systems Corp./Thomson-CSF contract proposal for the manufacture of the MSE. At the heart of the US-version of the RITA Mobile Subscriber Grid System (MSGS) is the GTE engineered and built second generation (analog/digital) Automatic Telephone Switchboard, SB-3614 and the third generation TRI-TAC circuit switch, AN/TTC-39. The baseline requirements for source selection now become the same requirements for operational testing and user acceptance. The Threat of Radioelectronic Combat will be a critical item of test and evaluation. Those protective measures interest in line-of-sight radio communications links and those designed into the tactical automatic switching system will be evaluated within the "baseline requirement . . .to provide communications for a notional five (5) division corps area of 37,500 Km^2 (13,500 $miles^2$), or 150 Km X 250 Km."[24] In the category of desired [vice essential] characteristics, the MSGS should "provide communications connectivity when elements of the tactical forces are widely dispersed (e.g., brigades or task forces clustered and separated from the main force by distances of up to 400 Km) [250 miles]."[25]

As described in Chapter II, the tactical user does not have the luxury of keeping current with the latest telephone directory changes. The age of the microprocessor and VHSIC have virtually eliminated that function in commercial "cellular, radio-telephone" systems. Therefore, the "smart" routing, tandem switching, and the flood search method of connecting one tactical subscriber with another across a corps' area of

operations will be a critical area for evaluation. The synchronization of the deep, close and rear battle simultaneously will require the utmost in C^3I speed of customer service. When time is of the essence in coordinating a CAS, Multiple-Launch Rocket System (MLRS), Lance, Joint Tactical Missile System-Army (JTACMS-A), or Tac Air BAI mission, there can be no human intervention in the routing of communications voice, data or facsimile traffic.

Writing in Armor magazine in the Fall of 1977, Lieutenant Colonel (then Major) L.D. Holder was a proponent for the use of enemy Electronic Warfare (EW) techniques in the conduct of wargames and the Army Training and Evaluation Program (ARTEP). Fort Hood and the III Corps have extended the ARTEP concept into what is called the ARTEP-based, Qualification Test (ABTQ). There is no better way to instill discipline into the C^3I operator and the decisionmaker than to "prohibit the use of radios or better still, to jam a training unit's nets for half the time given to field training . . .."[26] Without the use of FM-VHF Combat Net Radio (CNR) capability, the search for alternate means of communications is a significant "teaching point" at all tactical and operational levels of command. In more recent professional military journal publications,[27] LTC Holder draws upon his authorship of FM 100-5 and command experience with cavalry units both in Europe and the United States when he writes concerning operational exercises:

> Combat support and combat service support (CSS) are . . .inadequate to operational tasks. Generally, CSS units lack the mobility, sustainability and communications to support operations over extended times and distances. There are plainly too few CSS units in the force to support a solid operational capability . . ..The idea that support skills are so simple and unimportant that the Army can do without them until mobilization should be reconsidered.

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> Training exercises do not help much . . ..The large force exercises still held cast corps as player-controllers too often. When they do not, the exercises take place in areas so small that operational problems rarely surface and the requirements for large-scale [SIGMA-Star related] maneuver, fire planning, reconnaissance and support are not represented faithfully.
>
> There are useful things large units might do. Contintal U.S. Corps could run command post exercises over vast areas at small cost and great benefit to their staffs and commanders. Consider the potential or organizing a corps movement to contact from Ft. Hood, Tex., toward the Gulf Coast.[28] [italics added]

TRADOC Pam 525-7 (Joint Command, Control and Communications Countermeasures); Pam 525-16 (Joint Operational Concept, Joint Attack of the Second Echelon (J-SAK)); Pam 525-33 (Operational Concept for Army Airspace Management); Pam 525-45 (General Operating Procedures for Joint Attack of the Second Echelon):

Considering the state of Close Air Support (CAS) C^3I with regard to the use of MSE and PJH (Position Location Reporting System/Joint Tactical Information Distribution System-Hybrid) and the fact that the TRADOC-approved Tactical Communications Mission Area Analysis (TCMAA) was published in August 1980, it stands to reason that joint control of corps air space by the Air Support Operations Center (ASOC) and the Corps Airspace Management Element (CAME) in the CTOC requires the fastest and most volume-handling command and control network possible. How long will we in the Army tolerate the Tactical Air Control Party (TACP) elements to park an HF-SSB outside our command posts and radiate in an omnidirectional pattern 400 watts of highly "direction-findable" electronic signature. There has to be a better way of accomplishing the joint interdiction and airspace management missions. As LTC Holder points out:

> Air-ground cooperation has shown improvement since 1982 in response to the tactical arms of deep attack. While this has been worthwhile, the operational issues remain untouched, and those are among the most important relationships in a theater. [C^3I] links between ground and air . . .[campaign strategies] need reexamination and the question of control and allocation, a great sacred cow indeed, could benefit from review.
>
> It simply does not seem practical to manage air-ground coordination at the highest level of command [i.e., TACC/BCE: Tactical Air Control Center/Battlefield Coordination Element at the Air Component headquarters level] in every situation. What works in the scaled-down theaters of peace will not necessarily provide the flexibility, responsiveness and coordination necessary in a large campaign.[29]

TRADOC Pam 525-14 (Operational Concept for Contingency Corps Operations-1986); Pam 525-48 (Operational Concept for Logistics Support in a Nuclear, Biological, and Chemical (NBC) Environment):

Enclosed as ANNEX D is a command letter from the Commanding General XVIII Airborne Corps to the CG, FORSCOM addressing "a critical requirement for a tactical data transceiver capability to provide interface with the CONUS wholesale supply system during contingency operations and OCONUS exercises . . ..The Corps has been without this urgently required magnetic tape/data capability for over a year."[30] The 13 June 1985 letter prompted an urgent Letter Requirement (LR) for a down-sized (5/4-ton, S-250 shelter) capability, to be operated by noncommunications personnel working at "user friendly" terminals (i.e., requiring less than 2 hours operator training), and in keeping with the Dispersed Command Post (DCP) concept of operations, be located remotely from an automated message switch over a radio/cable system installed by the Signal Brigade.

Such a capability already exists in Europe as a prototype system. It encompasses the Army Vice Chief of Staff's guidance to decrease the size of C-E personnel spaces by shifting the burden of message traffic handling to the subscriber, who while waiting access into the world-wide common user communications network, can be formatting messages on a word processor-type terminal. The Signal Corps will provide the connectivity into the world-wide network. But, the real advantage of this capability is that it addresses a long overlooked requirement; namely, Command Post Survivability. In a September 1982 Military Review article a balance is struck between increasing CP survivability through frequent displacement versus dispersion as a widely distributed "cellular" CP.[31] Cited are the tests conducted in the mid-1970's by the Modern Army Selected System Test, Evaluation, and Review (Project MASSTER) at Fort Hood. Whether the MSE system can support a concept of CP dispersion measuring 15 Km x 10 Km is questionable; but, one worthy of field trial testing in the 1988 timeframe when MSE will undergo first article test and acceptance at Fort Hood. What remains to be done is for the Combined Army Combat Development Activity (CACDA), Fort Leavenworth, KS to publish a TRADOC Pamphlet 525-series operational concept spelling out the specifics under the same topical headings addressed in the 1982 magazine article. These were: location out of threat weapons range; hardening; size reduction; signature reduction; frequent displacement; deception; duplication; and, dispersion.

There is perhaps nothing more frustrating for someone in the materiel development business than to know that state-of-the-art technology exists for solving doctrinal requirements, but not being able to find a concensus in the military community for advocating change. In

the Army 1985-86 "Green Book" the man responsible for justifying the dollars spent each fiscal year for Army materiel and hardware programs, LTG Louis C. Wagner, Jr. Deputy Chief of Staff of the Army for Research, Development and Acquisition (DCSRDA) put the problem this way:

> We . . .need to concentrate on defining the requirements completely and clearly at the outset of a development, so it can be "designed right" the first time, without false starts. We cannot afford the "I think this is what I want" approach [e.g. Project MALLARD] to systems design. The user has to step forward and state clearly that a requirement exists. Those responsible for requirements [and their advocacy] must clearly define the parameters; and the development community has to quickly and economically build to the requirement, eliminating wasteful redesign.[32]

FINAL COMMENTS

ENDNOTES

1. William Raymond Manchester, American Caesar, (Boston: Little, Brown, 1978), p. 10.

2. Maj. Gen. T.D. Rodgers, Letter (ATZH-DAC), Subject: Signal Corps Update, (Fort Gordon: US Army Signal Center, July 9, 1985), Enclosure 1: Automation-Communications Proponency.

3. Ibid.

4. Robert G. Gard, Jr., "The Military and American Society," National Security & American Society, ed. Frank N. Trager and Philip S. Kronenberg (Manhattan: University Press of Kansas, 1973), p. 574.

5. Lt. Gen. William R. Richardson, "Winning on the Extended Battlefield," Army, June 1981, p. 42.

6. Reference Book (RB 101-34): Command and Control on the AirLand Battlefield. (Fort Leavenworth: US Army Command and General Staff College, August 1983), p. 5. This source is invaluable for anyone researching the growth of C^3I operational concepts as viewed from 99 authors in military journals over the period of almost 4 years. It is this writer's hope that an updated version will succeed the republishing of Field Manual 100-5: Operations in Mid-1986.

7. Lt. Gen. William R. Richardson, "Winning on the Extended Battlefield," Army, June 1981, p. 42.

8. GEN William E. DePuy, "Toward A Balanced Doctrine: The Case for Synchronization," Army, November 1984, pp. 21-23.

9. Ibid., p. 21.

10. Reference Book (RB 101-34), op cit., Maj Dennis H. Long, "Command and Control: Restoring the Focus," Military Review, November 1981, p. 46.

11. H. Bennett Teates, "The Role of Decision Support Systems (DSS) in Command and Control," Signal, September 1982. In the last chapter we saw that the Army had implemented MANPRINT (Manpower and Personnel Integration), a program designed to overcome the deficiencies with major weaon system developments due to a lack of emphasis on human engineering factors. In 1983 the Army Research Institute published a study which "determined that operational testing (OT) of [the STINGER Air Defense] shoulder-fired weaon tended to focus on the technical performance of the missile, rather than the performance of the total system (missile and gunner) under realistic combat conditions." (Quoted from: Jim Tice, "MANPRINT Attracts Attention From Congress," Army Times, February 3, 1986, p. 46). Human decisionmaking is an area which required extensive "front-end" analysis during the Mission Area Analysis (MAA) process and continuous evaluation during the RDA of a weapon or C^3I system development. Those human factors areas which impact on battlefield automation systems are the subject of an article by: MAJ Jack Laveson, "Human Factors considerations for C^3I," Army Research, Development & Acquisition Magazine, March-April 1983, p. 26. Maj Laveson writes:

> To illustrate the types of information needed, consider the data base required for automated C^3I. Data exist to determine keyboard and [video] display placements in conventional systems, but no data exist to define specific keys and key groupings or display format details for computer based systems.
>
> Reach times for various control locations are available, but only limited data exist for selecting computer response processing times . . .[and, user-operated system] concepts do not adequately address the limitations of human reasoning ability, human reliability, and human error probability.
>
> Other relevant factors are human short-term and long-term memory [e.g. training decay], auditory and visual sensing capability, and human information processing speed. All these qualities interact with computer system characteristics.
>
> When any system has a wide range of expected users, including everyone from novice through experienced, the whole range of human performance characteristics needs to be addressed. This complicates the data base, but it is a key human factors concern.

12. Ibid.

13. MAJ Richard Allen and Dr. Joseph Psotka, "Artificial Intelligence for Executives," Army RD&A Magazine, November-December 1985, p. 3. In a related article, Dorothy L. Finley and others from the Systems Research Laboratory, Army Research Institute and Office of the Project Manager, Training Devices liken embedded training (ET) to the "floppy disc" instructions for a personal computer. ARI is involved in the ET research program for the advanced weapon system: Fiber Optic Guided Missile (FOG-M). As a result of ARI's early involvement in a program the size, complexity and importance of FOG-M, perhaps the deficiencies experienced with the DRAGON antitank missile system training strategy will not be repeated. (More on the MANPRINT issue can be obtained by reading Jim Tice, op. cit., pp. 46-47, or Jim Tice, "Army Program Integrates Personnel Training and Weapons Design," Defense News, January 27, 1986, pp. 6-7) and Dorothy L. Finley and others, "Embedded Training and Systems Acquisition," Army RD&A Magazine, May-June 1985, pp. 20-21.)

14. General Donn A. Starry, "To Change an Army," Military Review, March 1983, p. 23.

15. Ibid.

16. Sherman Gee, Technology Transfer, Innovation, and International Competition, (New York: John Wiley & Sons, 1981), pp. 5-11.

17. As a follow-on to the combined Arms Tactical Training Simulator (CATTS) training device, the Army Training Battle Simulator (ARTBASS) is a computer-driven command post exercise. Nineteen ARTBASS systems are programmed for procurement and employement in CONUS and OCONUS. They will enhance wargame and field exercise play and provide:

> . . .real-time, free play, interactive simulation of tactical operations through the use of a digital computer [and digitized terrain map] based simulation system, an extensive mathematical model, and a data base. It is designed to train a Battalion Commander and his staff, and assists them to:
>
> . Enhance their command post procedures and techniques.
>
> . Quicken their decisionmaking processes.
>
> . Improve the interaction between staff members.
>
> . Exercise Command and control ARTEP tasks.
>
> . Develop their confidence.

The flexibility designed into the ARTBASS will also allow the system to be used for:

. New organization training.
. NTC preparation.
. Evaluation of Tactical SOP's.

(Quoted from: Army Training Battle Simulation System Pamphlet, (Fort Leavenworth: US Army Combined Arms Training Activity, 1983), p. 2.)

18. Edward N. Luttwak, "The Operational Level of War," International Security, Winter 1980/81, pp. 62-63.

19. Ibid., p. 65.

20. Sherman Gee, op. cit., pp. 12-13.

21. Ibid., p. 13.

22. Operational and Organizational Plan for Mobile Subscriber Grid System (MSGS), (Fort Gordon: US Army Signal Center, January 1984), p. 2-3.

23. Ibid., p 1-2. For example, compliance with NATO Standarization Agreement (STANAG) 4206-4211 which deals with digital (vice analog) communications transmission link and terminal equipment items, is planned for product improvement and subsequent life-cycle development testing (DT) and operational testing (OT). Also, because of the influx of new user computer-based systems (e.g., Advanced Field Artillery Tactical Data System: AFATDS), the testing of the MSGS will be incremental and involve the US Army Operational Test and Evaluation Agency's (OTEA's) Continuous Comprehensive Evaluation approach to life-cycle testing.

24. Ibid., p. 2-3.

25. Ibid., p. 2-8.

26. Reference Book (RB 101-34), op. cit., MAJ L.D. Holder, "Communications Alternatives," Armor, September-October 1977, pp. 52-55.

27. Three articles which come readily to mind are the following:

. Colonel Clyde J. Tate, USA, and LTC R.D. Holder, USA, "New Doctrine For the Defense," Military Review, March 1981, pp. 2-9.

. LTC L.D. Holder, "A New Day for Operational Art," Army, March 1985, pp. 22-32.

. LTC L.D. Holder, "Doctrinal Development 1975-1985," Military Review, May 1985, pp. 295-297.

28. LTC L.D. Holder, "A New Day for Opertional Art," op.cit., p. 32.

29. Ibid.

30. LTG James J. Lindsay, Letter, AFZA-CEAA, Subject: Tactical Data Transceiver Requirement, (Fort Bragg: XVIII Airborne Corps, June 13, 1985).

31. COL Richard M. Scott, USA and others, "Command Post Survivability," Military Review, September 1982, pp. 12-20.

32. LTG Louis C. Wagner, Jr., USA, "Soldier-First Attitude has 'New Prominence'," Army (1985-86 Green Book), October 1985, p. 256.

Annex A

TECHNOLOGY TRANSFER: An Economic Challenge to National Security

There is perhaps no greater challenge in the research, development, and acquisition (RDA)[1] field than the control of critical defense-related technology. As the focal point for all activities relating to the RDA of a major weapon or C^3I (Command, Control, Communications, Intelligence) system, the job of the Department of the Army System Coordinator (DASC) in the Pentagon is becoming increasingly more complex. Burdened as he/she is with all events (milestones) in the Life Cycle System Management Model for a major system, the recent emphasis placed on Security Assistance, RSI (Rationalization, standardization, Interoperability),[2] Foreign Military Sales (FMS), and issues of technology transfer in coproduction/codevelopment contracts with NATO nations have enormously complicated the DASC's job. This was an area not imagined by the drafters of the Army Regulation on the DASC system.[3]

It follows from our discussion in Chapter One of its impact on military structure, that we should examine the impact of technology transfer on military strategy. Particularly in the microelectronics and computer-based decision support system (DSS) area, technology transfer among coalition warfare allies is a necessary ingredient for a successful global military strategy. Because of the foreign policy and alliance agreements involved, technology transfer must be viewed from the national and international perspective, keeping in mind that technology transfer can be used as an instrument of "economic leverage" or "economic warfare" where one nation seeks to strengthen or weaken

another nation by providing or withholding the fruits of its commercial or defense industries.[4] In their book, The Economics of Defense in the Nuclear Age, Hitch and McKean assert "any power that lags significantly in military technology, no matter how large its military budget or how efficiently it allocates resources, is likely to be at the mercy of a more progressive enemy."[5] This Annex will also focus on the Department of Defense (DOD) published directives aimed at preventing direct or indirect transfers of technology to the Soviet Union.

MICROELECTRONICS (The "Chip")

At an Association of the United States Army (AUSA) symposium held at the Army War College, Carlisle Barracks in May 1982 on the AirLand Battle 2000, one of the functional area concepts developed dealt with the communications operations support needed by the combat arms to win the First Battle of the next war. The HQ, TRADOC document[6] produced from that symposium detailed the need for high-speed information transfer on the fluid and increasingly lethal battlefield. As it states:

> Secure voice, facsimile, real-time graphics [e.g. DSS] and video are used on the battlefield to rapidly transmit mission type orders and overlays. Multimedia input devices provide display of digital data in required formats. This rapid transmission of orders via secure data means allows the commander to take advantage of opportunities to attack the enemy when and where he is vulnerable and to initiate intended action before the enemy can decisively engage friendly forces. [Brackets, mine].[7]

Armor and mechanized infantry forces will play a significant role in the execution of AirLand Battle doctrine just as they did in

Germany's Blitzkrieg. As a former armor division commander, MG John W. Woodmansee, Jr. sees the Army's doctrine of land warfare[8] depending "in large part on our ability to distribute the information gained in microprocessors, embedded computers and data processing devices which are integral to the new systems." General Woodmansee continues his thesis by emphasizing that the microelectronic "chip" holds the technological key to our ability to see deep into the battlefield and support rapid decision-making. In the chip "lies the opportunity for an army, though outnumbered in a strategic sense, to mass superior power against an enemy force in the operational or tactical sense. Exploiting the chip will allow us to achieve surprise, gain and maintain momentum, seize the initiative, cause the enemy to react and set the stage for the confusion and paralysis of the enemy similar to the allies' reaction to the blitzkrieg."[9] The importance of microelectronics is realized when one considers that this technology lies at the heart of all modern battlefield sensor systems, target acquisition and processing microcomputers, fire control links, and logistics data systems. Its war fighting potential is measured in terms of the Soviet effort to obtain it.

Soviet-made carbon copies of computer microprocessors and pin-for-pin duplicates of printed circuit boards made by Texas Instruments Corp., provide insight into the Soviet Union's dependence on Western technology. Relatively speaking, the United States and its Allies benefit from a more useful interaction between the civilian and military RDA fields than does the U.S.S.R.[10] As the Director of Far/Mideast and Southern Hemisphere Affairs, Office of the Under Secretary of Defense for Research and Development, Dr. Francis Kapper is in a

position to comment on the Soviet Bloc's dependence. He states that although Soviet dependence has decreased, "despite several decades of Soviet priorities focused on science, technology and weapon systems, the Soviets, because of their inability to be innovative and effectively apply new technology to weapons developments, still depend on Western technology and equipment to develop and manufacture some of their advanced weapon systems more quickly."[11]

Insight into the Soviet lack of innovation comes from an article which appeared in the 13 August 1984 issue of U.S. News and World Report. The article focuses on the Soviet leaderships' fear of losing control over the distribution of data; "that an explosion in the information industry would allow ordinary citizens to become privy to vital state secrets or would enable computer-wise youths to break into sacrosanct central data banks. Such concerns far outweigh the attractions of a state-of-the-art computer system in a closed society."[12]

In a hallmark unclassified report, the Central intelligence Agency (CIA) projected the Soviet technological needs throughout the 1980's. As the report states:

> Today, Soviet military designers carefully choose the Western designs, engineering approaches, and equipment most appropriate to their deficiences and needs. These needs are still substantial and pervade almost every area of weapons technology and related manufacturing equipment...In certain of these areas, notably the development of microelectronics, the Soviets would have been incapable of achieving their present technology. In other areas, acquisitions have allowed the Soviets to reduce the indigenous effort they would otherwise have had to expend.[13]

For our purposes, we will concentrate on what DOD task groups have

identified as the fifteen (15) most critical technological areas.[14]

TECHNOLOGY TRANSFER: A must for Multinational Communications Networking

In Chapter Three we explored how innovation and the resultant effectiveness military weapon system developments is determined more from a critical review of needed capabilities (i.e. range, weight, size, etc.) than from a focus on available technologies. Although a "Buy American" syndrome has always permeated our defense spending,[15] the exchange of technology with out NATO allies in the form of codevelopment development and coproduction of weapon and C^3I systems can have beneficial effects. "Technology transfer offers the opportunity to obtain a greater return from past investments in R&D, but is not an end in itself. Its importance lies in its ability to stimulate and strengthen the innovation process."[16] Sherman Gee cites an historic example of how technology transfer can spur innovation from abroad. The example is the klystron tube, "a source of microwave energy invented in the United States in 1932 just prior to World War II...the technology was subsequently acquired and adapted by the British for airborne radar applications (and)...increased the effectiveness of their nighttime operations and is credited with helping win the Battle of Britain."[17]

A more recent example of the defense industries of the United States and abroad gaining from an exchange of technology is the international U.S./British/Candian/Australian program called MALLARD. It was begun in the late 1960 timeframe with the objective of producing the technical parameters for a tactical division/corps area communications network. The record is incomplete as to why combat and combat support interest in MALLARD waned. But, in May 1971, it was

replaced by the Joint Tactical Communications (TRI-TAC) Program established by DOD Directive, DODD 5148.7.[18] Regardless of the U.S. withdrawal, the British effort continued as project PTARMIGAN and on a close parallel technological course, the French developed their RITA (Le Reseau Integre de Transmissions Automatique).[19] Quoted in the February 1984 issue of the Armed Forces JOURNAL International, Donald C. Latham, Deputy Under Secretary of Defense for C^3I systems since July 1981, "describes TRI-TAC as a "whopping disappointment," noting that the program was 10 years in the process. So, in fact, was the hardware, with the system still not yet fielded. The Army, he observes, has made a radical change in philosophy toward smaller, light weight, more mobile equipment. Meanwhile, $700-million has been spent on TRI-TAC research and development."[20]

The AFJI article concludes by stating that the British and French systems "represent one of the most important new developments in European C^3I--and a dramatic example of where European technology has leap-frogged American ingenuity and bureaucracy."[21] In large measure, this situation is the result of a marked downturn in U.S. technological R&D in the 1970's.[22] As statistics of R&D expenditures (as a percentage of Gross National Product) show..."the more favorable R&D trends in foreign countries compared to the United States are significant because they occur at a time when the united States is exporting much of its technology. The implication is clear that the relatively stronger foreign commitment in R&D has provided the wherewithal by which American technology is adapted and upgraded into

improved commercially [and militarily] competitive products."[23] And, this situation exists today-in view of the fact that: (1) "Soviet leadership (has) established as a national goal the attainment of world leadership in science and technology;"[24] (2) the potential for international trade and domestic employment resulting from the defense industry FMS market is enormously profitable, and; (3) the danger exists for U.S. developments not being standardized or interoperable with European systems which will "impair the combat effectiveness of NATO operational forces and contribute to inefficient utilization of available alliance resources."[25]

CONTROL

From the standpoint of national security and economic leverage, a major issue is the control of those technologies where the United States has an advantage. The degree of economic warfare between the Superpowers is likely to increase as the Soviets perceive themselves falling behind in weapons and C^3I systems development. However,"if the United States is to conduct such a [economic warfare] policy successfully, it will have to put both its own house and the allied camp in order."[26] Such is the viewpoint of Jordan and Taylor toward the Coordinating Committee of the Consultative Groups of Nations (COCOM). Established in 1949, and composed of Japan and all nations comprising NATO (except Iceland), the COCOM has developed a criteria and system by which strategic exports can be controlled. However, the news media is filled with successful evasions of trade controls by the Soviets,[27] and serious reservations exist "that America's allies will want to renovate [the COCOM] mechanism or take any other measures that will further constrain them in this field."[28] This situation leaves the

U.S. with no option but to develop, unilaterally, a coherent methodology and practical set of ironclad rules for evaluating and enforcing a system of technology transfer.

The President is required by statute[29] to control the transfer of technology to foreign governments. Publication of DOD Directive 2020.2 (Subject: Control of International Technology, Goods, Service, and Munitions Transfers) on 17 January 1984 is indicative of the concern the government has for control of critical technology. The directive prescribes policy procedures and responsibilities, and requires the Armed Services to participate on the DOD International Technology Transfer Panel. As a further outgrowth of the directive, another approach for controlling the flow of critical technology data "while still cooperating with out allies as much as possible has been the relatively new International C^3I Program established by the Office of the Deputy Under Secretary of Defense (C^3)." As International President of the Armed Forces Communications and Electronics Association (AFCEA), Dr. Jon L. Boyes describes the new methodology as follows:

> This program has a goal, the improvement in the overall DOD understanding of C^3I activities and capabilities around the world in order to improve the processing of technology transfer cases.
>
> The core of the program is the development of a comprehensive C^3I data base for all countries/regions except for those in the Warsaw Pact. Information in the data base will consist of descriptions of command and control structures and systems, communications systems (strategic, tactical, and civil) and air defense systems.[30]

CONCLUSIONS

Control over critical technology transfer may be "a leaky bulwark"

as concluded by Jordan and Taylor,[31] but the advantages of sharing defense-related information with out Allies far outweigh the potential loss of technology across our borders. With the U.S.S.R.'s focus on microelectronics, VLSI/VHSIC (very large-scale/very high-speed integrated circuits) and microprocessor technology, and the 10 to 15 year lag in U.S. R&D investment, the need is to maximize technological advancement both at home and abroad. As the TRI-TAC/European C^3I example demonstrates, the U.S. is not the world leader in all R&D fields and that intentional technology export can reap beneficial technology imports.

ENDNOTES

1. Generally speaking, the terms research ("is investigation of physical phenomena which may add to our store of knowledge") and development ("is undertaken to convert the scientific innovation into an operational element of security policy") are synonymous with science and technology. The term acquisition refers to the decision to take a weapon system development into production and eventually into the Army inventory. Definitions in quotes obtained from Amos A. Jordan and William J. Taylor, Jr., American National Security Policy and Process (Baltimore: Johns Hopkins University Press, 1981), pp. 312-313.

2. See Army Regulation 34-1, United States Army Participation in International Military Rationalization/Standarization/Interoperability (RSI) Programs (Department of the Army, 1979) for definitions of RSI.

3. Army Regulation 70-16, Department of the Army System Coordinator (DASC) System, (Department of the Army, 1975).

4. The terms "economic leverage" and "economic warfare" are taken from Jordan and Taylor, op. cit., p. 306.

5. Charles J. Hitch and Roland N. McKean, The Economics of Defense in the Nuclear Age (Santa Monica, Calif.,: Rand Corp., 1960), p. 246.

6. Headquarters, United States Army Training and Doctrine Command, AirLand /Battle 2000 (Fort Monroe, VA: Office of the Chief of Staff, August 1982), pp. F-1 to F-15.

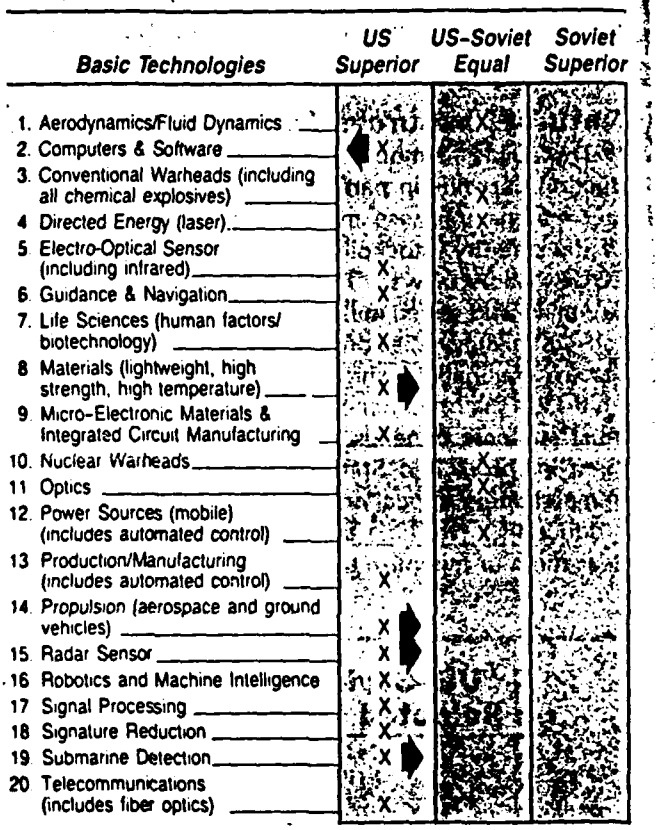
7. Ibid, p. F-3.

8. Department of the Army, Field Manual 100-5, Operations (Washington, DC: USGPO, August 1982).

9. John W. Woodmansee, Jr., Major General, USA. "Blitzkrieg and the AirLand Battle," Military Review, August 1984. Analyzes how the new FM 100-5 doctrine is producing significant changes in the way the Army will have to fight on the future battlefield against larger enemy forces. In a recently published report by the JCS, the "quantitative disadvantage" issue was addressed as a challenge to the "technological leadership" of the United States. As the JCS publication states:

> One United States approach to countering numerically superior enemy forces is to field qualitatively superior forces of our own, concentrating resources to produce technology-intensive combat and combat-support forces capable of achieving decisive results. This approach requires the United States and its allies to maintain the lead in critical military technologies. Technological progress increases the deterrent value of US forces and provides a hedge against a Soviet technological breakout. US advanced technology also imposes strategic costs on the Soviets by causing them to divert resources from more easily produced systems in order to counter new, more capable US systems. The importance of technology has never been more obvious than it is today. Yet, as Figure 11-6 indicates, the US lead in several key technologies is slipping. Strong US and allied technological bases must be maintained if their qualitative lead in fielded systems is to be retained.
>
> Oraganization of the Joint Chiefs of Staff, Military Posture FY 1987, (Washington, DC, US Government Printing Office, February 1986), p. 16.

Relative US–Soviet Standing in the Twenty Most Important Basic Technology Areas*



* The list is limited to 20 technologies, which were selected with the objective of providing a valid base for comparing overall US and USSR basic technology. The list is in alphabetical order. These technologies are "on the shelf" and available for application. (The technologies are not intended to compare technology level in currently *deployed* military systems.)

The technologies selected have the potential for significantly *changing* the military capability in the next 10 to 20 years. The technologies are not static; they are improving or have the potential for significant improvements; new technologies may appear on future lists.

The arrows denote that the relative technology level is *changing* significantly in the direction indicated.

The judgements represent overall consensus for each basic technology area. The USSR may be superior in some of the subtechnologies making up each basic technology.

These average assessments can incorporate a significant variance when individual components of a technology are considered.

As of 1 January 1986 **FIGURE II–6**

Fig. 11-6

10. Jordan and Taylor, op. cit., p. 323.

11. Dr. Francis Kapper, "Soviet Acquisition of Western Technology. Signal. January 1983.

12. Nicholas Daniloff, "Why Soviets Are Behind In Computer Technology." U.S. News & World Report, 13 August 1984, pp. 37-38.

13. According to the author, the 15 most critical technological areas are: computer networks, large computer systems, software, automated real-time control, composite and defense materials processing and manufacturing, directed energy, LSI-VLSI (large-scale integration, very large-scale integration of microelectronic circuits) design and manufacturing, military instrumentation, telecommunications, guidance and control, microwave components, military vehicular engines, fiber optics and advanced optics, sensor, and undersea systems. This list was compiled by Sherman Gee, Technology Transer, Innovation, and International Cooperation (New York: John Wiley and Sons, 1981), p. 53.

14. Gary K. Bertsch and John R. McIntyre, National Security and Technology Transfer: The Strategic Dimensions of East-West Trade (Colorado: Westview Press, 1983), P. 99, as cited from a Central Intelligence Agency report titled: Soviet Acquisition of Western Technology.

15. With a military defense budget in the hundreds of millions of dollars, and the economic impact that defense programs can have regionally, "members of Congress are keenly interested in defense contracts and frequently cooperate with firms from their states to promote proposals with the Defense Department." Explaining the pressure that is brought to bear by the domestic defense industry, the following is a quote from William P. Snyder, Making US National Security Policies, rev. ed., (Carlisle Barracks: US Army War College, 24 August 1982), pp. 19-20:

> The relationship between large industrial firms and the military establisment has been of concern to many Americans. Some observers charge that the "military-industrial complex" ("MIC") causes major inefficiencies in defense procurement, and cite cost "overruns," schedule delays, and large earnings of defense contractors as evidence of these inefficiencies ....[some] allege the "MIC" is too influential in terms of the types of weapons developed and tested, thereby causing the government, to buy little-needed or obsolete equipment.
>
> [Others allege that] major defense contractors are heavily technology-oriented, and their proposals for new weapons systems may stress new technical processes at the expense of realiability and simplicity. Moreover, the orientation of the major

contractors did not enable them to foresee the emergence of "wars of national liberation," which required military eqiupment of a different character..." [italics added]

16. Sherman Gee, op. cit., p. 19.

17. Ibid., p. 25.

18. The Joint Tactical Communications (TRI-TAC) Program was established by DOD Directive 5148.7 in May 1971 to coordinate the development and assure the interoperability of tactical communications equipment to satisfy Army, Navy Air Force requirements. It was further established to prevent duplication of equipment and systems by the Services; to provide tactical communications facilities with greatly increased Communications Security (COMSEC) capability; and to provide greatly improved tactical communications capabilities in an orderly transition from present analog systems to predominantly secure, digital systems.

19. The French acronym RITA translates as Automatic Integrated Transmission Network. Both the French I Corps in northeast France and the Corps in Germany are equipped with a fully deployed RITA system.

20. Leon Smith, Capt. USN (Ret.). "C^3I--The New Euorpean Systems." Armed Forces Journal International. February 1984, pp. 54-60.

21. Ibid., p. 60.

22. Jordan and Taylor, op. cit., pp. 319-324.

23. Sherman Gee, op. cit., pp. 63-64.

24. U.S., Congress, House, Committee on Armed Services, Statement by the Director of Defense Reserarch and Engineering, Dr. John S. Foster, Jr., on the Fiscal Year 1973 RD&E Program, 92nd Cong., 2d ses., February 29, 1972, mimeographed, pp. 1-2., as cited by Jordan and Taylor, op. cit., p. 323.

25. Sherman Gee, op. cit., p. 59.

26. Jordan and Taylor, op. cit., p. 309.

27. Two excellent articles appeared recently in the Defense Systems Management College publication: Caspar W. Weinberger, Secretary of Defense. "Our National Security Strategy," pp. 2-5; and Edith B. Buffalo, Major, USAF, and Thomas C. Rogers. "The Soviet Copycat Technocrats" Program Manager. (Washington, D.C.: USGPO, Jul-Aug 1985), pp. 6-11.

28. Jordan and Taylor, op. cit., p. 309.

29. These statutes are: the Mutual Security Act of 1954, as amended; the Army Export Control Act of 1976; and the Export Administration Act of 1979, as cited in Bryant R. Dunetz, Assistant Deputy for International Research, Development and Standardization, Army Materiel Command (AMC). "Controlling Critical Technology." Army R, D&A (Alexandria, VA: HQ DARCOM, May-June 1984), pp. 1-2.

30. Dr. Jon L. Boyes, Vice Admiral, USN (Ret.) "Technology Transfer--Is There a Middle Ground?" Signal (Burke, VA: Armed Forces Communications and Electronics Association, May 1984), pp. 19-20.

31. Jordan and Taylor, op. Cit., P. 309.

ANNEX B

C^3I PRINCIPLES: Fundamentals for Success and Survival on the Battlefield

The following SHOOT, MOVE, and COMMUNICATE, principles were presented to the Command and General Staff College, Fort Leavenworth, KS on April 17, 1974 by the Assistant Chief of Staff for Communications-Electronics, Department of the Army (ACSE-E, DA), MG Thomas Matthew Rienzi. General Rienzi's presentation was titled: "User's C-E Commandments," and the ten axioms of tactical communications he sets forth, more than meet MG Holley's criterion for a principle: "validated only by long use and widespread acceptance . . .[whose measure of effectiveness is the] extent to which it facilitates and illuminates the decisionmaking process."[1] [italics added]

I. COMMUNICATIONS PLANNING: Thou shalt not make any plan, be it war contingency or operational, without full consideration of communications, including preparation for alternate and degraded communications.

II. COMMUNICATIONS REQUIREMENTS: Thou shalt remember that acceptable communications requirements demand user participation and validation and specify minimum needs.

III. COMMUNICATIONS DISCIPLINE AND ECONOMY: Thou shalt think and plan before communicating--do not talk excessively, nor prepare lengthy messages, nor abuse [message] precedence.

IV. COMMUNICATIONS SECURITY: Thou shalt be scrupulous regarding the security of communications and particularly be mindful of radio transmissions in the clear.

V. COMMUNICATIONS SYSTEMS: Thou shalt at all times assure that communications are managed as a complete system, committed to serving the caller to caller and writer to reader.

VI. C-E OFFICER: Thou shalt employ your C-E Officer as a full member of the combined arms team; help him in his needs and insure he is properly and undividedly accountable for reliable communications.

VII. ELECTROMAGNETIC COMPATIBILITY: Thou shalt be mindful of the radio [frequency] spectrum as a scarce resource and so plan and manage, that our emitters do not interfere with each other.

VIII. ELECTRONIC WARFARE: Thou shalt always be mindful of electronic warfare [EW/REC: Radioelectronic Combat]; protect yourself at all times; be prepared to strike electronic blows at the enemy by continually ascertaining his C-E potential.

IX. MANEUVERS AND EXERCISES: Thou shalt play all aspects of communications and electronics in maneuvers and exercises in order to be familiar with and trained in their capabilities and limitations.

X. SHOOT, MOVE, AND COMMUNICATE: Thou shalt bear witness to the inseparability of "SHOOT, MOVE AND COMMUNICATE"--the trinity of combat power--and maintain balance and harmony among them.

The next item has to do with a letter promulgated by General Don A. Starry when he was Commanding General of V Corps, Frankfurt, Germany. Anyone who was at the divisional or Corps levels at the time Gen. Starry was commanding knows that C-E support was at its peak, and the Army Training and Evaluation Program (ARTEP) for Signal Battalions was as close to "the real thing" as resource constraints would permit. The following is from the letter from Lieutenant General Starry, Commanding General, USA, Headquarters, V Corps, APO New York 09079, (AETVCS-C), SUBJECT: Signal Communications and Command and Control of the Battle, dated 16 June 1977:

1. We have stated that there are major communications problems in commanding and controlling the Corps battle - and have asked for help. The problems we have described are not new ones, they occur during every large-scale exercise should one care to observe.

2. Help outside V Corps is being provided; although not immediate, you can expect to see some results in the near future. Meanwhile, there are day-to-day challenges we must meet to help ourselves. The most important contribution we can make is in training, especially in communications. Each commander must insure that the signal team is integrated as an essential element of unit training. It is important to commanders - without it we can't command.

3. A signal element does not have to go to Grafenwoehr in order to conduct meaningful training. A few local areas, suitable for overnight occupancy separated enough to approximate tactical field conditions, are sufficient to conduct tough valid, training programs. No signal element can set up in the motor pool or at fixed sites that they have worked from many times and then expect to successfully support a fast moving combat operation throughout Land Hesse.

4. Senior signal officers tell me that commanders must not hesitate to say what we realistically need and that we should expect to get it. Commanders must articulate the tactical signal communications requirement, allocate available resources [to include time and subscriber terminals, e.g., TACFIRE, DAS3, etc.], and then insist on the requirements being met. He must see that the signal officer comes up with a way to do it. Command and control of the corps battle requires a tough, well-trained team with a good dialogue between the commander and his signal officer. [Italics added]

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[1]Major General I.B. Holley, Jr., Air Force Reserve (Ret.), "Concepts, Doctrines, Principles: Are You Sure You Understand These Terms?," Air University Review, July-August 1984, p. 92.

ANNEX C

A C^3I HARDWARE REQUIREMENT: Friendly Forces Warning (FFW) System for CAS Aircraft

Attached as enclosures are the following:

Enclosure #1: Description of the hardware requirement, as asked for by the Department of the Army (DAMO-FDQ) and hand-delivered on 29 October 1985 prior to a scheduled OSD Defense Resources Board (DRB) meeting on that same day.

Enclosure #2: Hughes Aircraft Company (Communications Systems Division), Fullerton, CA marketing brochure, "PLRS/JTIDS Hybrid," obtained from the Project Manager's officer, PLRS/TIDS, US Army Communications-Electronics Command, Fort Monmouth, NM 07703. What the brochure reveals (p. 7) is that JTIDS equipped USAF aircraft can be identified by Army Air Defense Artillery (ADA) but, unlike Army helicopters, do not have the capability of identifying/recognizing friendly ground forces in the execution of an air strike.

Enclosure #3: Rockwell International, Cedar Rapids, Iowa, marketing brochure also obtained from the Project Manager, which reveals that the Class 2 JTIDS terminal developed by Rockwell-Collins and the data processor group developed by Singer-Kearfott Division has the capability of providing the pilot a cockpit JTIDS display, so that he "can select information about his aircraft and from other aircraft on JTIDS Nets to display: . . .Location of friendly and hostile ground forces." The display shown, also includes a front-line trace of the Forward Edge of the Battle Area (FEBA).

ISSUE: C^3I Hardware Needs of Close Air Support

BACKGROUND: The air war over North Vietnam and close air support (CAS) role of the USAF in the RVN revealed the difficulty of passing radar and ground location information to high performance aircraft pilots who were being attacked by enemy aircraft or in the process of delivering ordnance bomb loads. The UHF/VHF radio got saturated with voice traffic and the information (data) was based on map coordinates or ground checkpoints. The pilots were required to make map coordinate conversions in their head to use the data. Pilots assigned CAS missions at the National Training Center (NTC), Fort Irwin, CA are still making air strikes the same way today as 15 years ago.

The AirLand Battle (ALB) and Low Intensity Conflicts (LIC) will feature a nonlinear battlefield with friendly forces widely dispersed as strong points of defense, long-ranged reconnaissance patrols, forward artillery observers, and limited objective maneuver elements, to name a few. High performance aircraft delivery of ordnance is imprecise even when controlled with Tactical Air Control Party (TACP) teams (using voice radios) at the combat brigade or battalion levels. The speed, azimuth of attack, and characteristics of the weaponry onboard the aircraft are variables which determine the margin of safety to friendly forces during a CAS mission. Control of CAS through voice radio is not as effective as computerized data display.

STATEMENT OF NEED: There is a critical need to have all USAF aircraft which are missionized for close air support equipped with a Friendly Force Warning (FFW) data display. Similar in concept and electronic design as the Identification Friend or Foe (IFF) devices employed in an

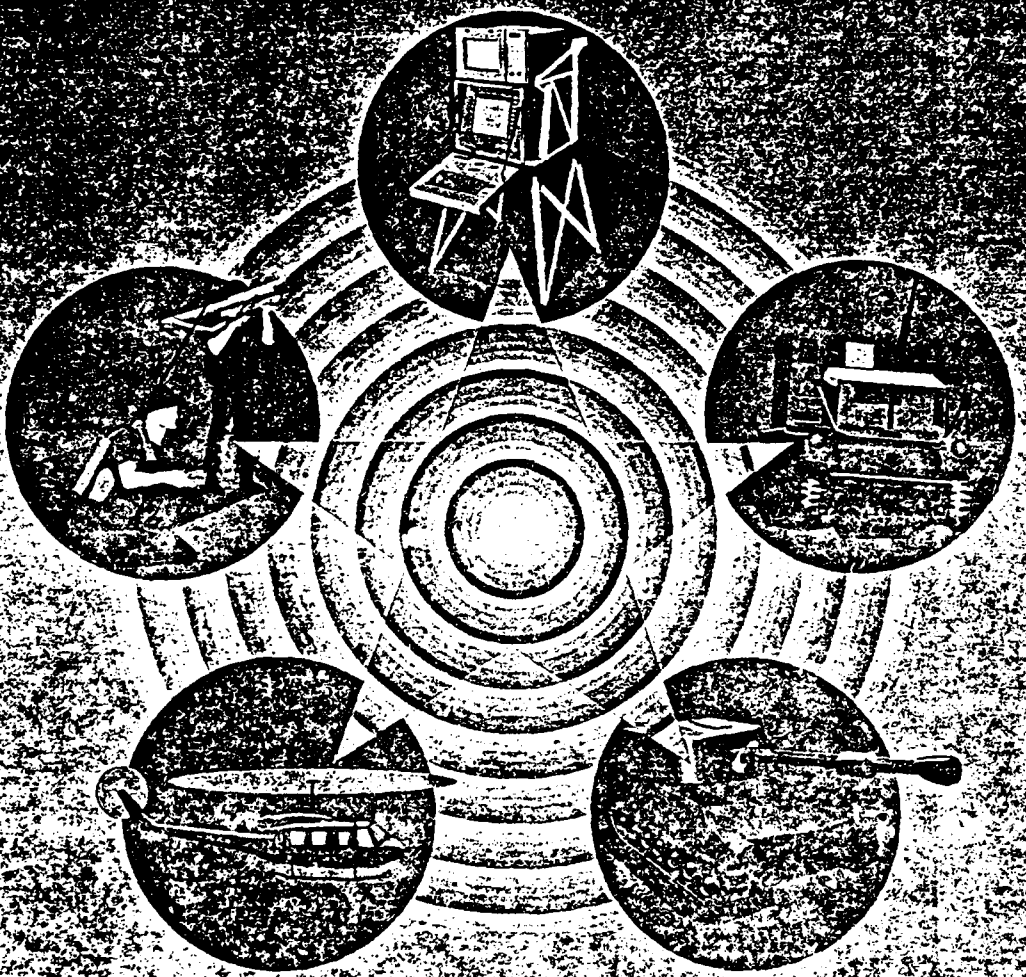
ENCL #1

air defense role, a pilot would be warned of the proximity of friendly ground forces right up to the instant of safe discharge of his weapon systems or delivery of ordnance. The factors of air speed, direction of flight and ordnance type would be computed in determining the FFW display activation.

RECOMMENDATION: The USAF, with participation by the Army, Navy and USMC, is the lead Service in the Joint Tactical Information Distribution System (JTIDS) program. The program features the integration of voice, data, and identification systems into a common, modular design. The Army/USMC Position Location and Reporting System (PLRS) is currently being expanded to incorporate the JTIDS capability. Specifically, the Enhanced PLRS User Unit, either modified or unmodified, offers the USAF an opportunity to equip CAS aircraft with a capability to acquire digital data on friendly ground force locations. FFW signals can be transmitted to the pilot through his head-up display (HUD) in the cockpit.

HUGHES
AIRCRAFT COMPANY
GROUND SYSTEMS GROUP

PLRS/JTIDS HYBRID



COMMAND CONTROL COMMUNICATIONS ON THE BATTLEFIELD

With the PLRS/JTIDS Hybrid System, the forward observer's location and identification are automatically relayed back to the fire direction center without relying on an FM radio network. His data message goes out over the data communications system.

PLRS/JTIDS Hybrid System Evolution

The advent of high technology sensors and weapons systems on the modern battlefield presents a challenge for command control communications never before faced by the US Army. The delicate international balance of power makes it imperative for the Army to fully extend its capabilities through the use of these technological advances. Many of these systems have embedded computers on board. The integration of systems and weapons is part of the winning strategy, but it requires a highly reliable and survivable real-time data communications system.

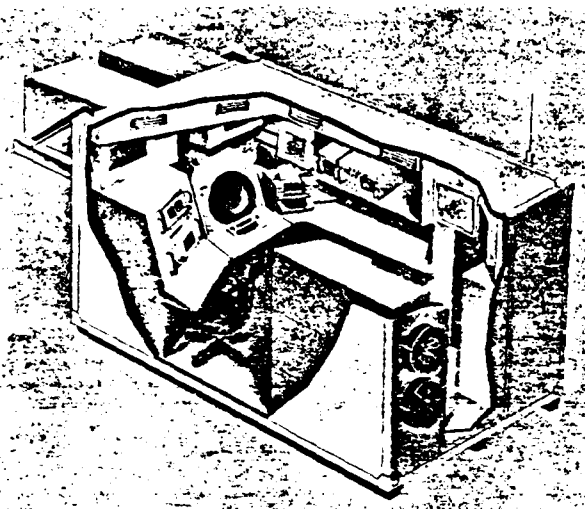
PLRS/JTIDS Hybrid provides the Army with a highly reliable communications system for the battlefield. With its automatic identification, position location, reporting and navigation capabilities, the PLRS/JTIDS Hybrid introduces an important new era to command control systems.

PLRS/JTIDS Hybrid integrates the proven capabilities of two systems already developed—PLRS, the Army/Marine Corps Position Location and Reporting System, and JTIDS, the Joint Tactical Information Distribution System. The features of PLRS and JTIDS, enhanced by hardware and software modifications and expanded data processing, give the Army two interoperable real-time data communications systems, which are reliable, secure and jam resistant.

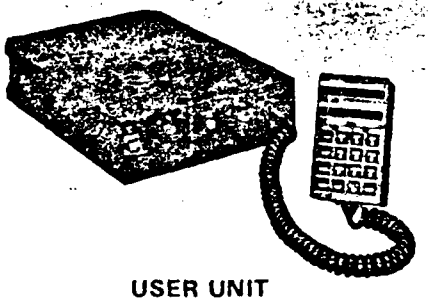
In the Hybrid system, the PLRS User Unit is modified by firmware change, a new secure data unit, and the addition of a small interface module that works with other tactical data systems in the battlefield. The resulting Enhanced PLRS User Unit (EPUU) will be configured for manpack, vehicular and airborne applications. The PLRS Master Station evolved into the Hybrid Net Control Station (NCS) through the addition of a JTIDS Class 2 terminal and additional data processing capabilities for automatic net management for data communications.

With these changes, the PLRS identification, position location and reporting facilities are supplemented with additional communication capabilities, and the resulting enhanced PLRS system is integrated with JTIDS.

PLRS

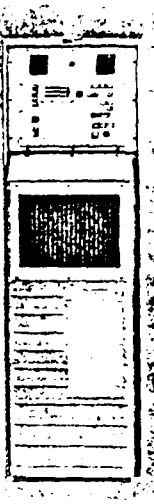


MASTER UNIT

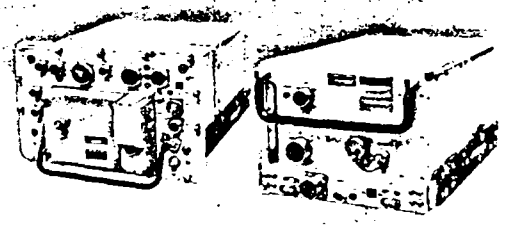


USER UNIT

JTIDS

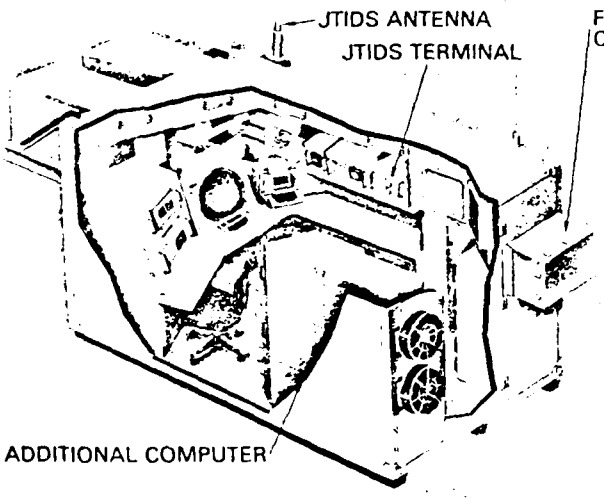


CLASS 1
COMMAND AND CONTROL TERMINAL

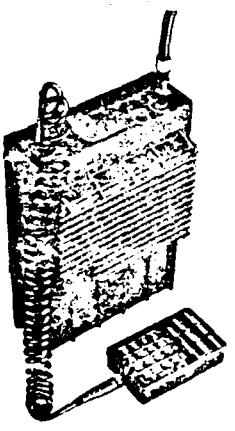


CLASS 2
(AIRBORNE CONFIGURATION)

PLRS/JTIDS HYBRID



NET CONTROL UNIT



ENHANCED
PLRS USER UNIT

JTIDS - CLASS 2
(ARMY)

PLRS/JTIDS Hybrid in Action

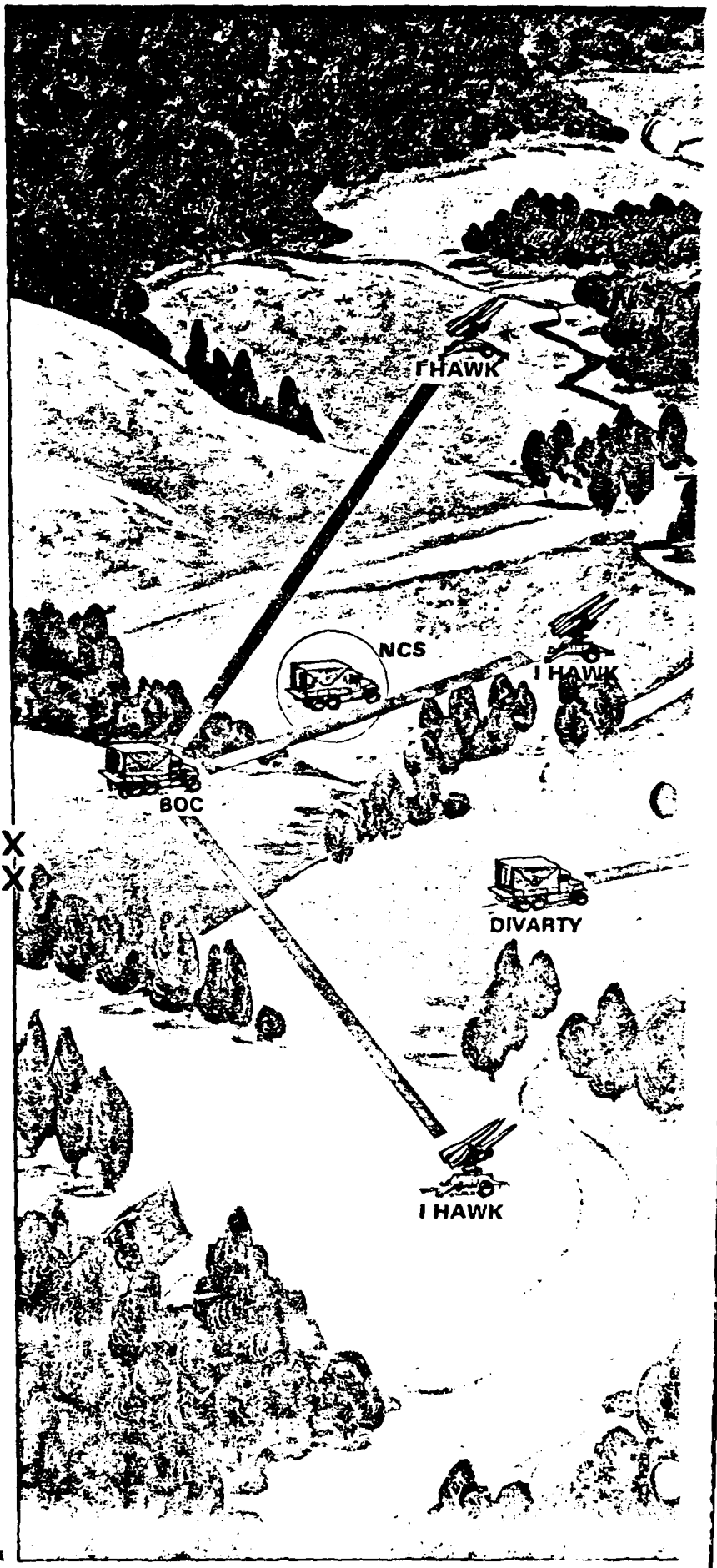
Enhanced PLRS User Units in manpack, vechicular mounted or heliborne configurations provide user-to-user data communications, identification and position/navigation services to the Army units both in the air and on the ground. Through the JTIDS interface, links also can be established with Air Force aircraft flying in support of division and corps operations.

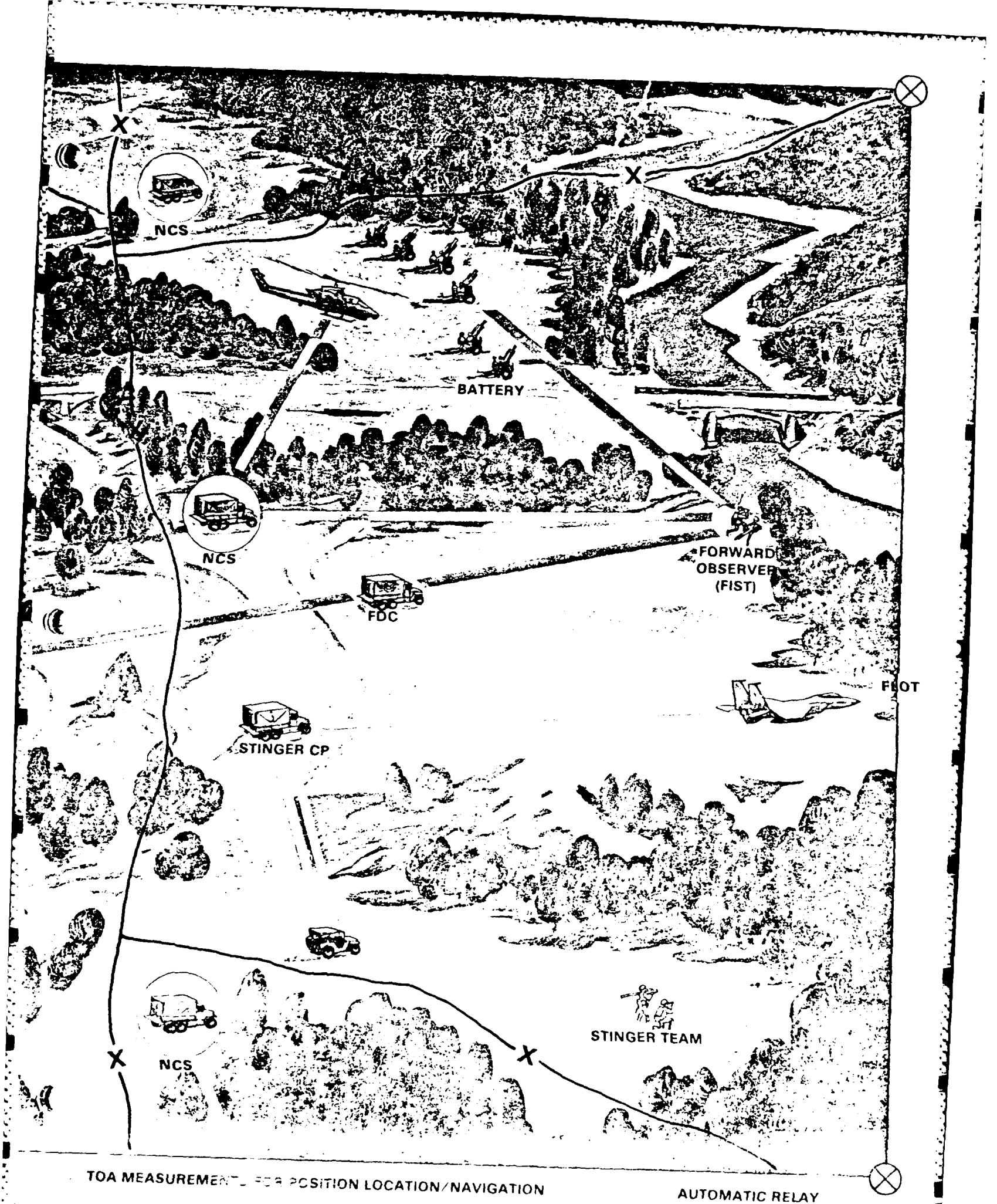
The lightweight, militarized EPUUs supply the necessary mobility needed for the rapidly changing and demanding conditions found on the battlefield. The majority of Hybrid system participants can satisfy their data distribution requirements with this versatile, reliable and easily operated unit.

JTIDS terminals will be used at centers with a very high digital message traffic or joint service interface requirements. For example, the Hawk Missile Battalion Operation Center (BOC) requires the high digital message traffic capability of JTIDS to distribute air track information and to quickly identify JTIDS equipped aircraft entering the division area. JTIDS identification data is automatically distributed to Short Range Air Defense (SHORAD) units in the forward area.

Net Control Stations located in each brigade and in the division rear manage the data distribution function and provide position location navigation and identification services. Data communication requirements, including response time and message traffic requirements, for each tactical area is specified by the NCS operator. The NCS automatically selects two independent paths for each needline and allocates sufficient time slots to accommodate the specified response time. The NCS controls both the JTIDS and PLRS nets, and automatically selects the appropriate terminals as relays in these discreet nets.

Continuity of Operations in the Hybrid system is assured by a software design that permits data communications to continue along established needlines is an NCS is suddenly lost. If this occurs, the division's NCS or adjacent brigade's NCS automatically assumes net control. Additional continuity of operations is assured by the placement of a fifth NCS in the division rear to assume net control either during planned displacement or during the unplanned sudden loss of the division's NCS.

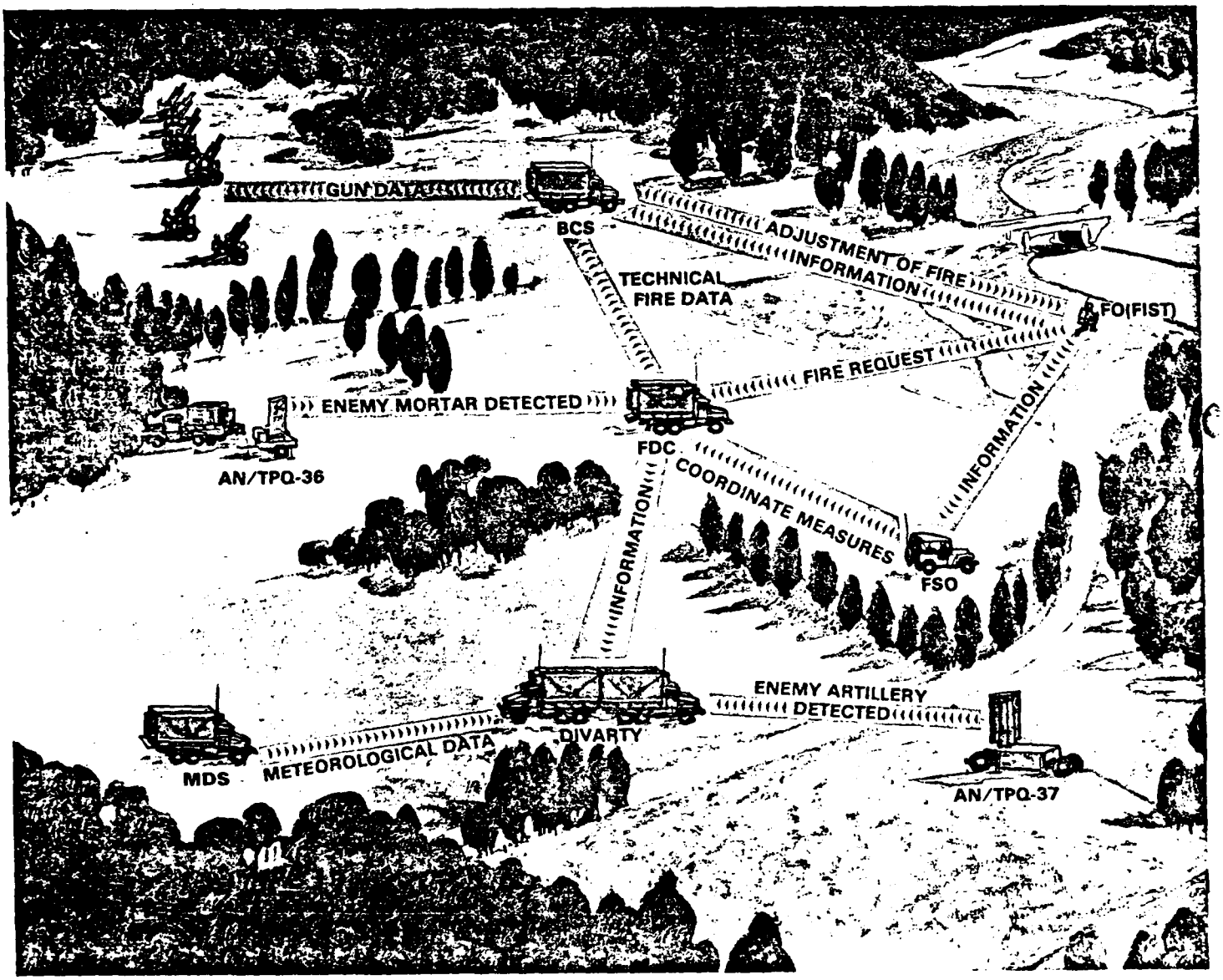



NCS
BATTERY
NCS
FORWARD
OBSERVER
(FIST)
FDC
FIOT
STINGER CP
STINGER TEAM
NCS
TOA MEASUREMENTS FOR POSITION LOCATION/NAVIGATION
AUTOMATIC RELAY

PLRS/JTIDS Hybrid System on the Battlefield

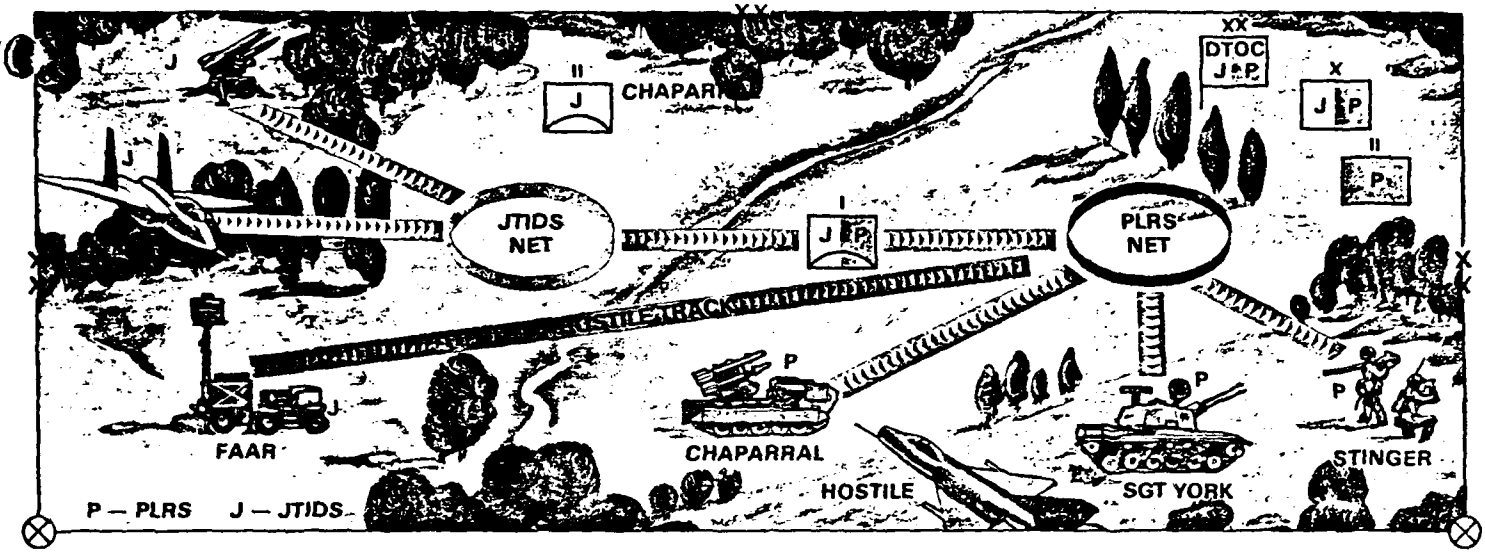
The far-reaching capabilities of the PLRS/JTIDS Hybrid apply to a wide variety of mission areas. Data communication, position location reporting/navigation and identification functions are available to all users, but the relative value of each function varies according to the mission area in which the system is applied. Five functional mission areas — Fire Support, Air Defense, Combat Service Support, Maneuver and Intel/EW — illustrate the system's complete versatility.

FIRE SUPPORT



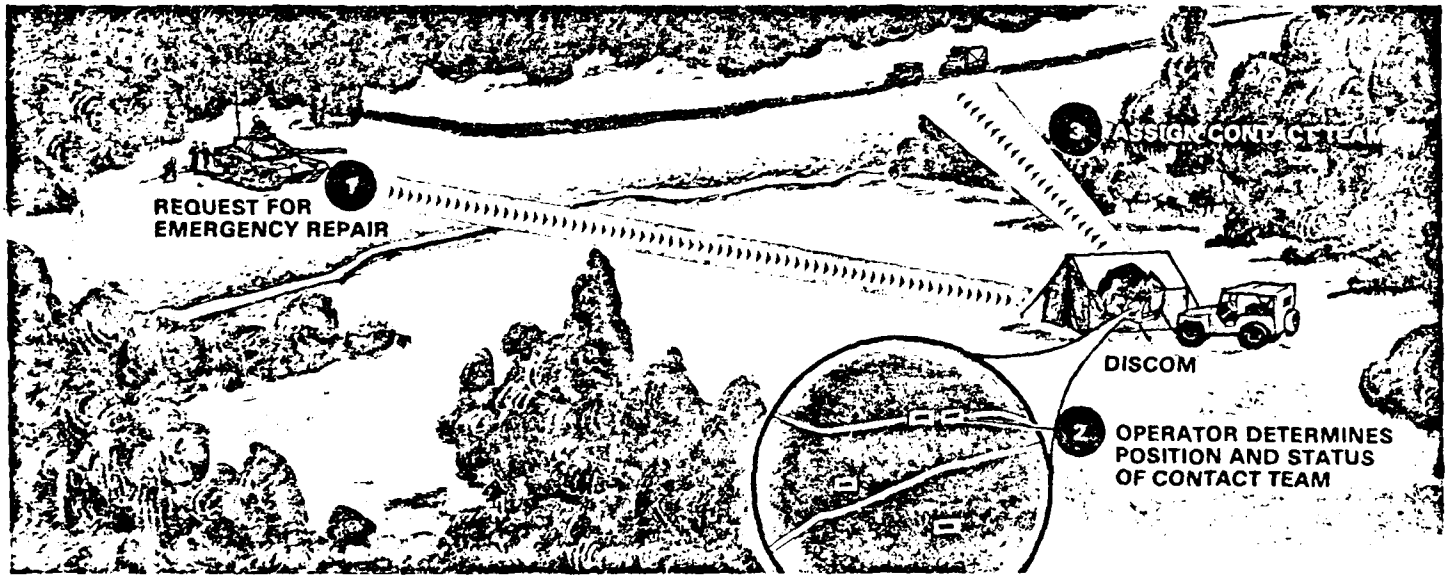
Fire Support benefits immensely from the system's ability to distribute artillery fire requests and mission support data simultaneously to multiple destinations. A forward observer (FO) can initiate an artillery fire request using an EPUU connected to a digital message device and can have this request automatically routed to the fire support team (FIST), fire direction center (FDC), fire support officer (FSO) and the battery computer system (BCS) at the artillery battery. Subsequent mission processing and the coordination of mission execution also benefit. Mission response time is improved, while operator workload and transmission error are reduced. Automatic position location and reporting, automatic position identification, highly reliable real-time and near real-time communications, and data distribution to multiple users on the battlefield — the system's full complement of capabilities — are utilized

AIR DEFENSE



A modern air defense system demands a PLRS/JTIDS Hybrid type of system on the battlefield. Reliable automatic netting for the distribution of air track and command control information is a key factor in air defense operations. As illustrated above, the Hybrid's netting capability together with the system's real time identification fo. friendly helicopter and fixed-wing aircraft significantly increases the effectiveness of SHORAD units such as the Stinger, Chaparral and Sgt York. A SHORAD unit can use the EPUU connected to a digital communications terminal (DCT) to quickly identify all friendly and enemy aircraft entering its sector. The system's versatile data communications netting capability also greatly improves the coordination between air defense elements and supported ground forces.

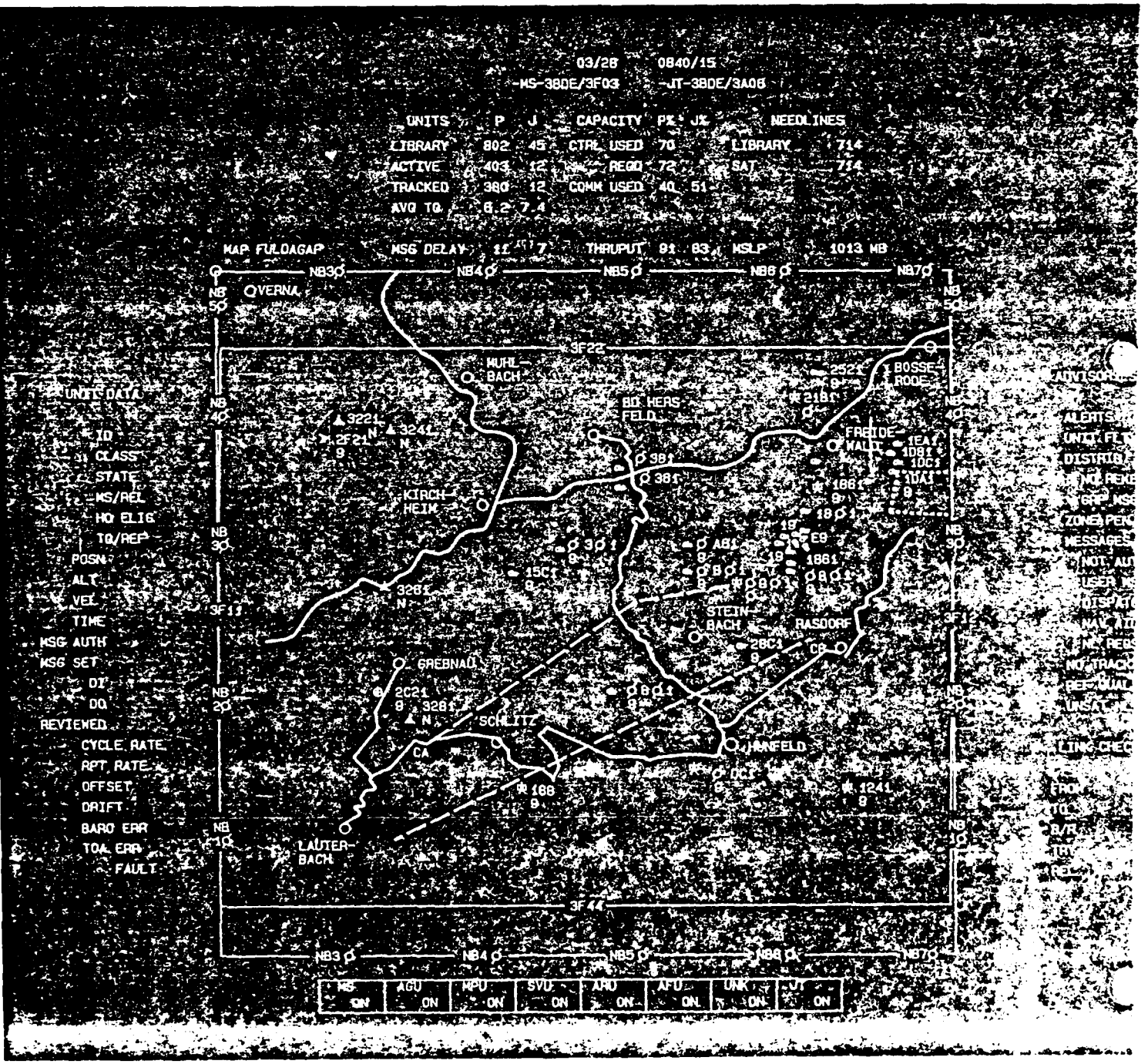
COMBAT SERVICE SUPPORT



The data communications and position location reporting/navigation functions of the PLRS/JTIDS Hybrid play an integral role in logistics support operations. The above illustration shows a situation where a disabled tank using an EPUU requests assistance from a Division Support Command (DISCOM) unit. DISCOM immediately displays the location and status of contact teams and the location of the disabled tank. The appropriate contact team is then selected and guided to the disabled vehicle using the system's position location reporting and navigation. The same capabilities also apply successfully to other combat service missions such as convoy control and medical evaluation

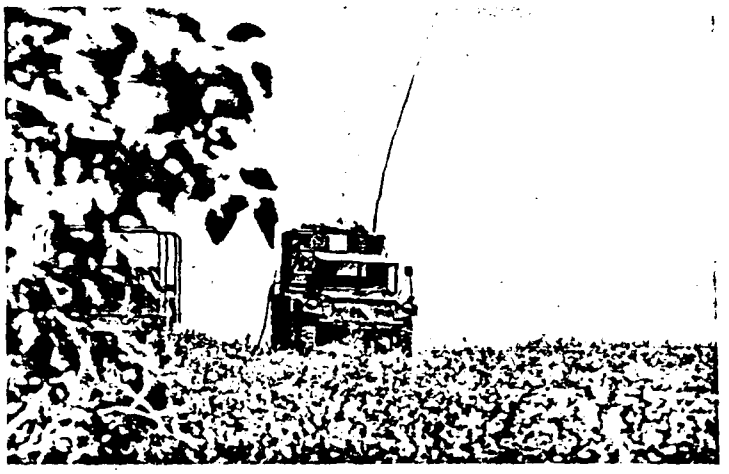
MANEUVER

Scope identification, position location and operational status information displayed on the NCS operator's console are available for distribution to command control centers. The operator selects by category those units desired for display. With the Hybrid system, the operator also can offset the display center and change scale on the display. In addition, all other tactical and geographic display capabilities of the PLRS Master Station are available with the NCS. The display below shows the identification, location and status of all tank companies in a Fulda Gap scenario.

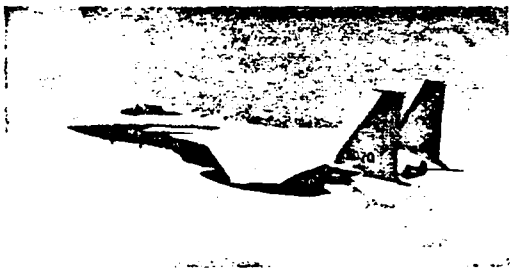


INTEL/EW

Intelligence/Electronic Warfare fulfills the demanding requirement of collecting data from widely dispersed systems in the forward battle areas, processing and then disseminating the information back to the combat force. The Hybrid provides the precise locations needed for accurate direction finding computations and for the real-time transfer of information required for control of the Intel/EW systems. Perishable data can be collected and sent immediately to upper echelons. Tactically located sensors and control stations can be linked by the Hybrid's automatic relay to intelligence control and analysis elements at division or corps command echelons. This position location information and communications enhances the control and coordination of sensor systems, which are especially important in integrated air and ground operations.

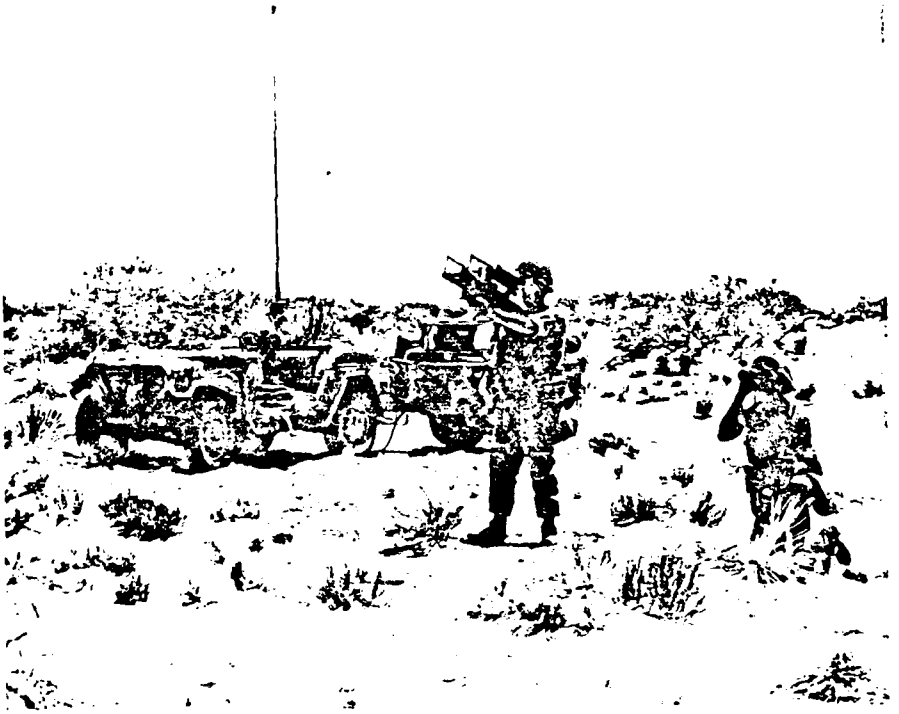


Identification and Location of Friendly Forces



JTIDS equipped fixed-wing aircraft can be positively identified by SHORAD units in real time.

Helicopters equipped with EPUUs can quickly identify any friendly unit on the battlefield.

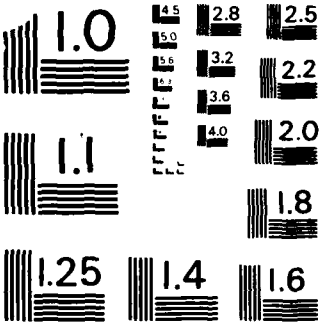


With the PLRS/JTIDS Hybrid, Stinger teams operating in the forward battlefield area receive positive identification of all friendly aircraft in the SHORAD sector.

Positive identification on the battlefield is essential to effective command control. A key identification requirement exists between friendly aircraft and SHORAD units, and the Hybrid system provides the capability to identify EPUU equipped helicopters and JTIDS equipped fixed-wing aircraft. This [illegible] battlefield area. Identification increases the safety of friendly air operations and permits a more responsive reaction when hostile aircraft enters a SHORAD unit's sector. With this identification feature, helicopters operating over the battlefield and maneuver elements on the battlefield can quickly locate and identify friendly units [illegible] tactical attack. Overall effectiveness benefits greatly from this improved coordination.

AD-A170 701 CORPS AREA COMMUNICATIONS SUPPORT OF FM 100-5 (OPERATIONS) DOCTRINE(U) ARMY WAR COLL CARLISLE BARRACKS PA B A JENSEN 31 MAR 86 3/3

UNCLASSIFIED F/G 17/2 NL



Five Phase Evolutionary Program

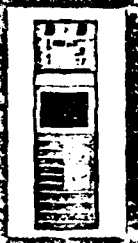
Because of the near term need, the PLRS/JTIDS Hybrid System has been identified by the Department of Defense and the Department of the Army as a program for accelerated development. A five phase evolutionary development and evaluation program has been designed to meet a first unit equipped (FUE) in 1988 US Army.

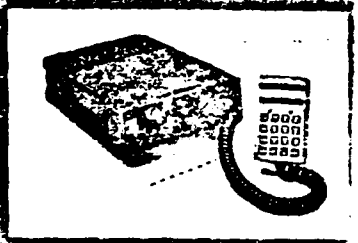
PHASE 1

System definition and concept evaluation was completed in 1981.

PHASE 2

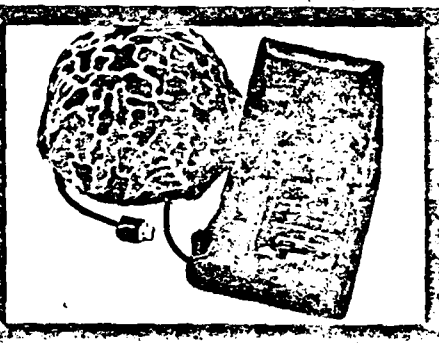
Verified the interoperability of PLRS and JTIDS by exchanging data between the two systems in accordance with Army user specified scenario information. This phase was completed in 1982.

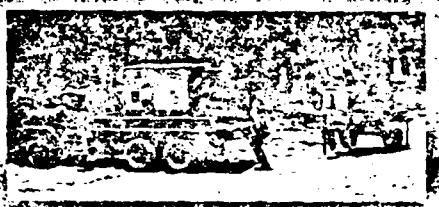


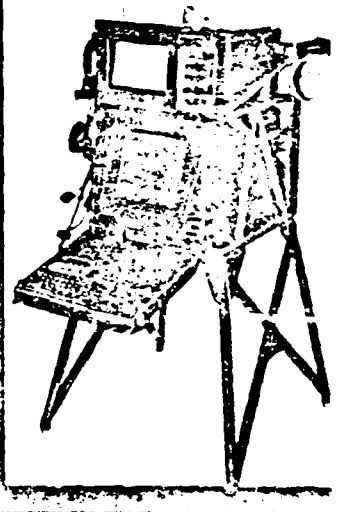


PHASE 3/4

In order to expedite the system development, Phases 3 and 4 were combined. This effort began in 1983 and ended in 1986; provided a complete prototype system to be tested in-plant. The combined Phase completed the development of the EPUU and provides the full software capability for the NCS, including net management. Phases 3 and 4 establish an interface capability with selected weapons and command control systems and integrate JTIDS Class 2 terminals into the system.

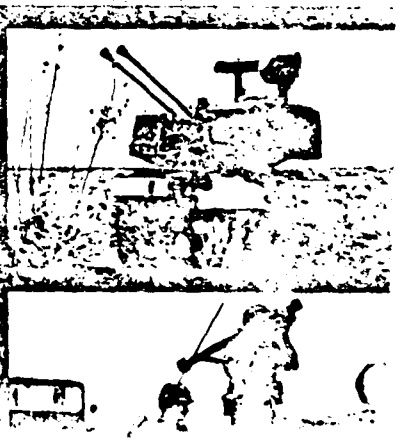






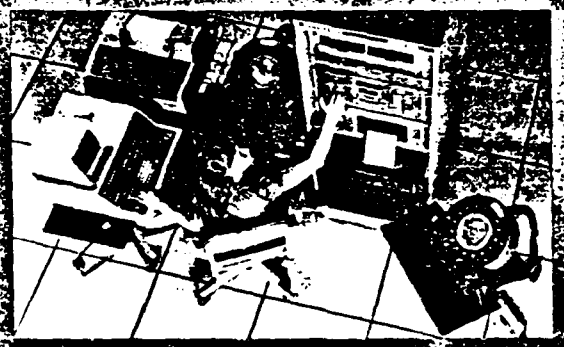
PHASE 5

Completes the development of a division level system, including logistics support and training for operational testing. The development and testing of the PLRS/JTIDS Hybrid will be completed in 1987, with a planned first unit equipped in 1988.



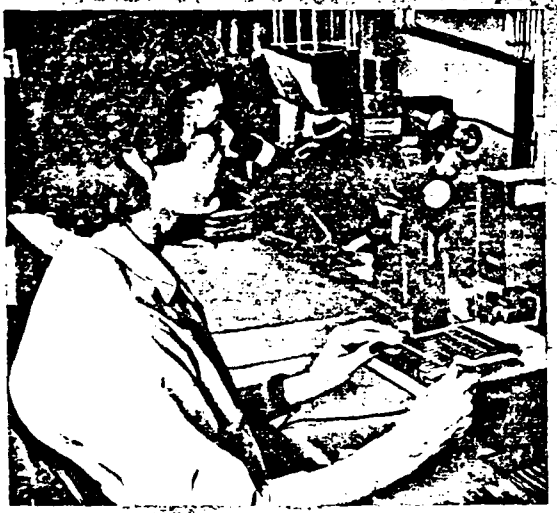
GSG MANUFACTURING...

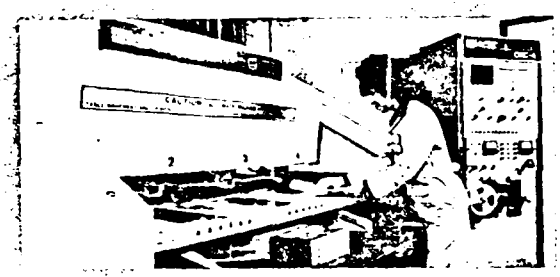
Advanced Technology in Action

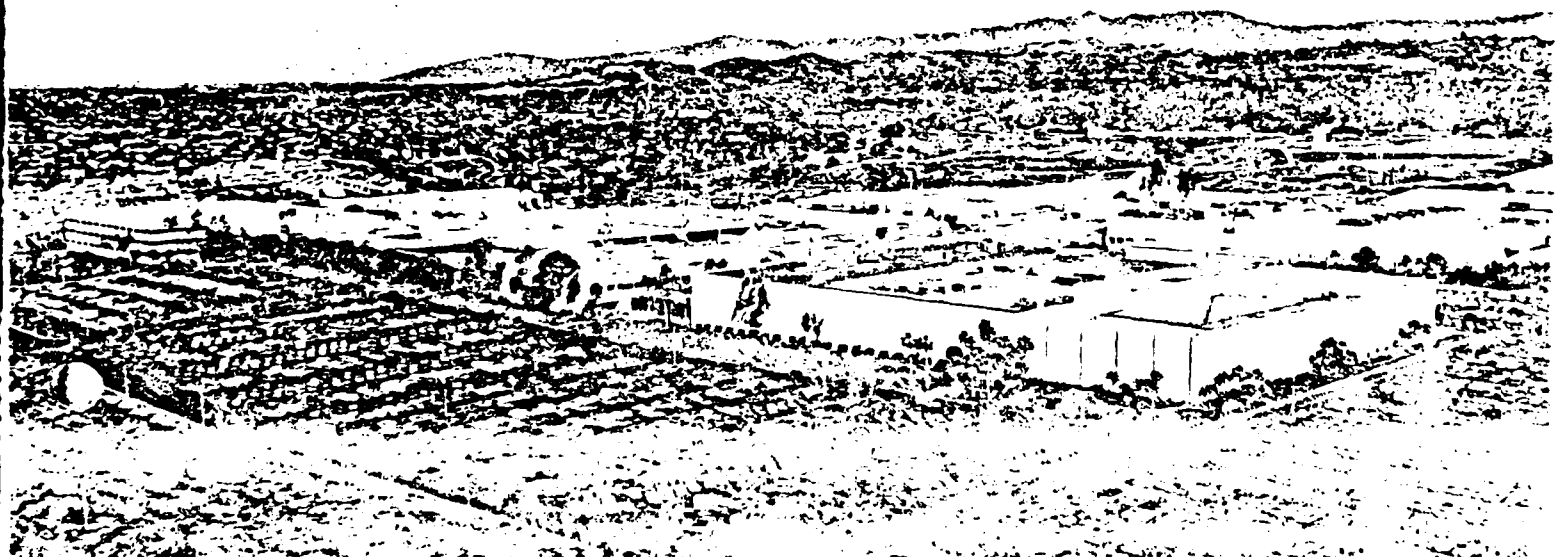


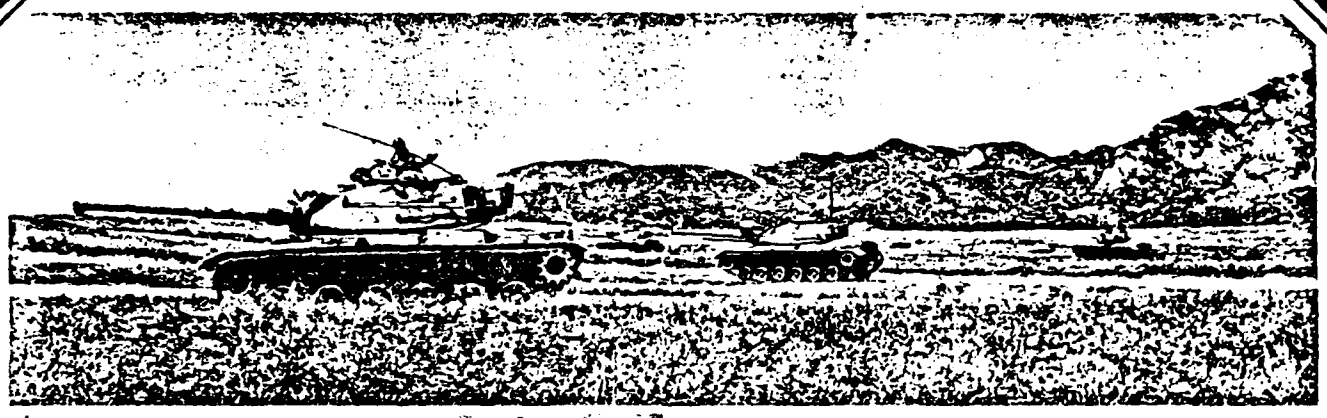
One of many automated test positions designed, built and used in Manufacturing, this In-Circuit Component Inspection Tester tests wire harness sets and backplanes for the PLRS/JTIDS Hybrid.

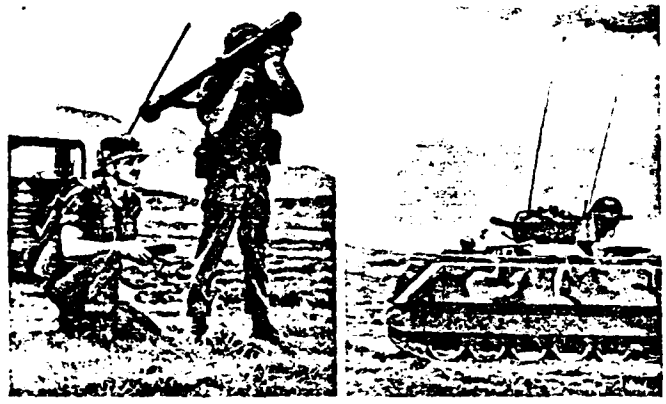
Routing: an intricate pattern of wires inside an electronic component takes time. Assembler efficiency increases when this is done with a semiautomatic wire routing machine pioneered by Hughes.

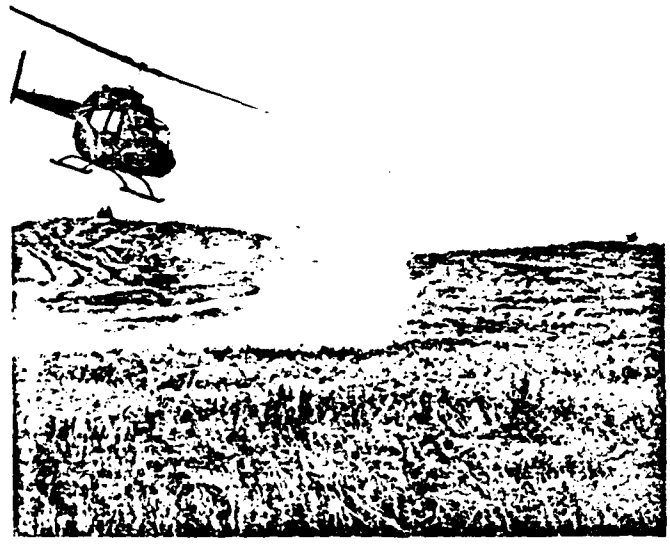


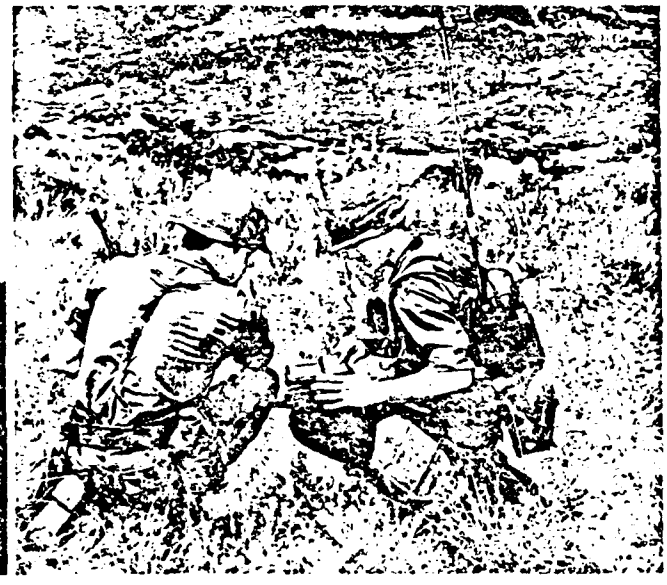








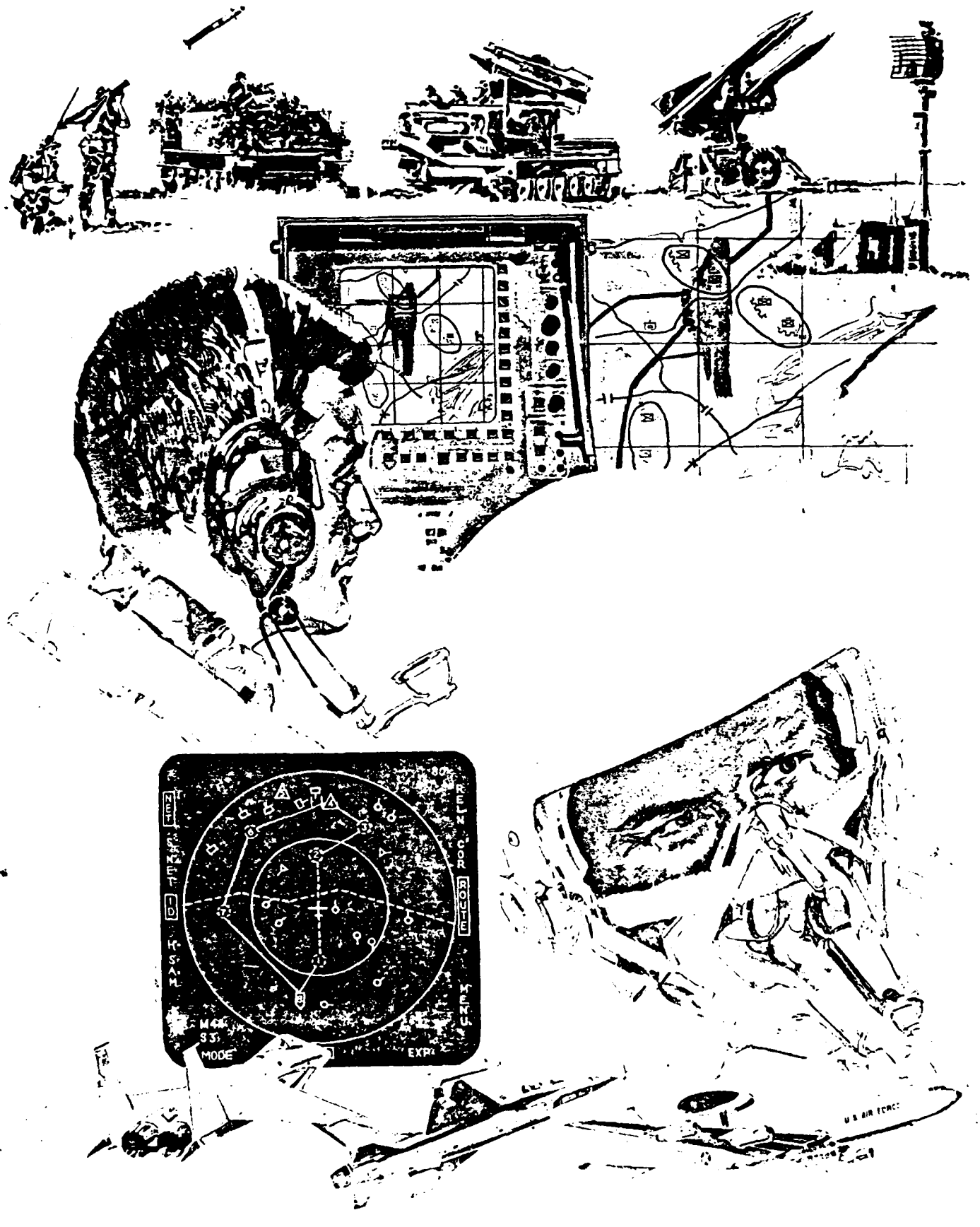




HUGHES
AIRCRAFT COMPANY

Direct inquiries to Marketing Manager, Communications Systems Division, P.O. Box 3310, Fullerton, California 92634
Telephone (213) 802-4910

Collins JTIDS-TDMA Class 2 Terminal



ENCL * 5

U.S. Air Force and Army JTIDS Class 2 Terminal

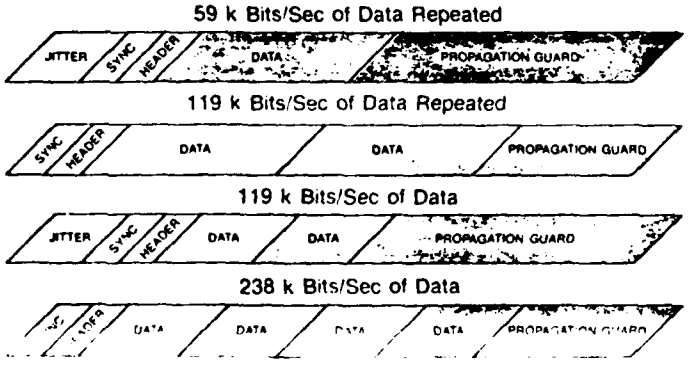
In today's increasingly complex military environment, one of the major tasks facing our military is to prevail against a well equipped enemy while dealing with severe jamming of radio communications.

Our fighter aircraft, ground forces and powerful antiaircraft weapons all operate within the same battle area. To be effective in their individual missions, as well as to avoid engaging friendly forces in combat, each must know its location in relation to both friendly and hostile forces, in real-time. It is imperative that information generated by friendly forces be shared in the immediate area and the entire battlefield. This information must be highly-accurate, easy to understand and as up-to-the-minute as possible. Reliable communications will increase the effectiveness of our combined forces in the combat arena.

JTIDS Increases Force Effectiveness

The Joint Tactical Information Distribution System (JTIDS) provides a proven method of tactical information exchange. The basic architecture of JTIDS was selected to distribute varied types of information to many tactical elements on a real-time basis.

Information can be exchanged assuring that the right information is available to the right person at the right time. For example, data from E-3A AWACS aircraft, with a field of view over hundreds of miles, can be instantly shared with fighter aircraft in the air and with friendly ground forces. This enables a fighter to "see" an enemy beyond visual range and air defense commands to immediately distinguish between hostile and friendly aircraft.



Selectable Formats for Future Operational Growth

JTIDS Information is broadcast omnidirectionally at many thousands of bits each second and can be received by any terminal within range. Information flows directly from many transmitters to many receivers using a frequency-hopped, time-sequenced transmission scheme. Each terminal, ground or airborne, can select or reject each message according to its need for that information.

Thousands of users can participate on a single network. A single message might contain information such as fuel and ordnance reserves. Other messages on the same network from the same or other sources could contain information about position, track and altitude of hostile aircraft. Another network could be providing command and control, mission status or voice messages.

JTIDS: A Proven System

JTIDS employs a communication method called Time Division Multiple Access (TDMA) which permits new up-dated messages to be sent from numerous terminals on a specific network in a time-sequenced basis.

Extensive testing and operation by both U.S. and NATO forces have dramatically demonstrated the benefits of TDMA JTIDS in the coordinated ground and air tactical environment. Since 1979, TDMA JTIDS has been utilized by airborne command and control, and tactical units in exercises at Eglin Air Force Base. The benefits demonstrated in these activities have committed the U.S. Air Force, Army and NATO forces to TDMA JTIDS for providing their tactical, multifunction data communications.

The TDMA method contains a unique propagation guard period which assures that the TDMA system will provide data throughput over the 300 nautical mile range without other subscribers transmissions causing self-interference. This is especially important in tactical environments with a high concentration of JTIDS

Jam Resistant ■ Nodeless Operation ■ High Capacity ■ Real-Time Information ■

Reduced Size and Weight ■ Digitized Voice and Data ■ Interfaces with Comm

terminals, such as in the coordinated ground and air combat environment.

Another important feature of JTIDS is a passive mode of operation which permits the subscriber to maintain radio silence while still receiving updated mission and threat information.

Jam Resistant Data Communications

JTIDS is a jam-resistant system using spread spectrum techniques and fast frequency hopping to distribute the transmitted data over a frequency band of several hundred megaHertz. Additional protection against jamming is accomplished through the use of a Reed-Solomon Forward Error Correction code. This code permits reconstruction of the information content of a message even if up to fifty percent of the pulses are lost.

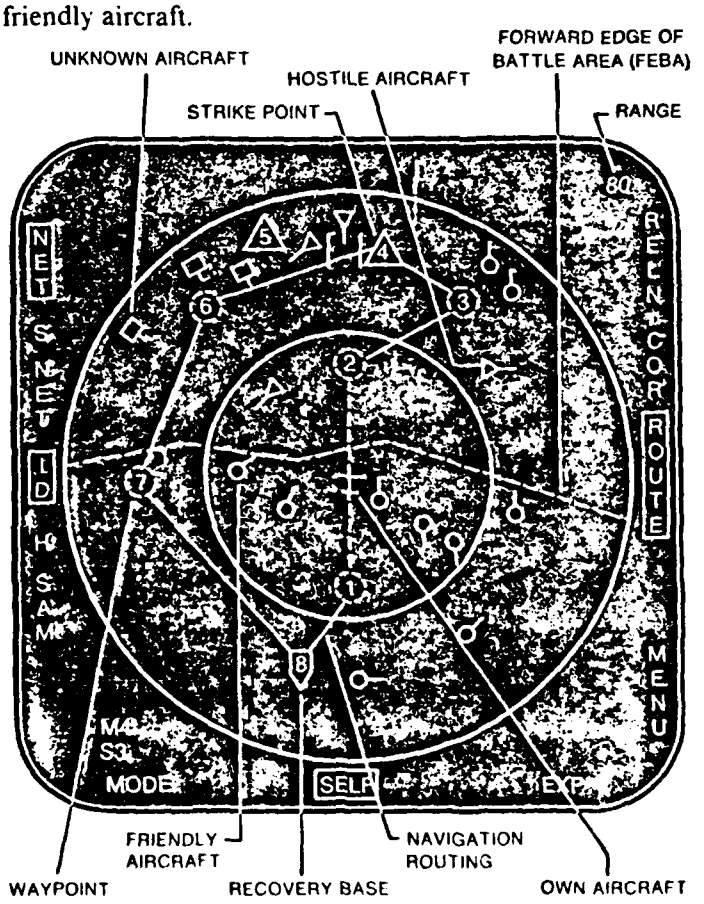
JTIDS simplifies complex Tactical Air Operations

A JTIDS equipped F-15 or F-16 fighter aircraft will use on-board navigation, weapons and radar systems to automatically feed status information to the JTIDS terminal and then to a JTIDS net. This information includes target data, own aircraft position, altitude, ground speed, direction, fuel reserves, weapon reserves and radar signature returns. The airborne JTIDS terminal also contains a TACAN subsystem. By using the cockpit JTIDS display unit, the pilot can select information about his aircraft and from other aircraft on JTIDS Nets to display:

- Navigation situation including waypoints and targets.
- Location of surface-to-air missile sites.
- Friendly air bases and alternate recovery bases.
- Location of friendly, hostile and unknown aircraft.
- Location of friendly and hostile ground forces.

The pilot can select various display ranges between 5 and 320 nautical miles to see information beyond his visual line of sight and the aircraft's radar range.

The pilot can determine a friendly aircraft's fuel and weapon status [illegible] could support him or [illegible] mission. The pilot can also assign to himself, or be assigned a particular aircraft target. These assignments will be identified over the JTIDS nets to other subscribers so that a unified target assignment can be coordinated. This permits each friendly aircraft to track assigned and unassigned threats and to be continually aware of which are assigned to him. This is especially important in a dense airborne threat environment and greatly reduces surprises and engagements of the same threat by more than one friendly aircraft.



U.S. Army PLRS/JTIDS Hybrid Integrates Communication

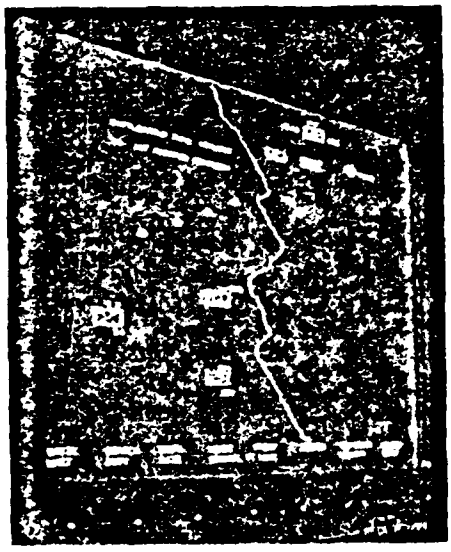
The JTIDS Class 2 terminal will be used with the U.S.

yptographic Secure ■ Integrated CNI ■ Displays and Antennas

Army Position Location and Reporting System (PLRS) to form a PLRS/JTIDS hybrid. In the hybrid system, information can flow between airborne sources such as E-3A AWACS, F-15 and F-16 aircraft and ground data sources such as division, brigade and battalion centers as well as manpack, vehicular or helicopter user units.

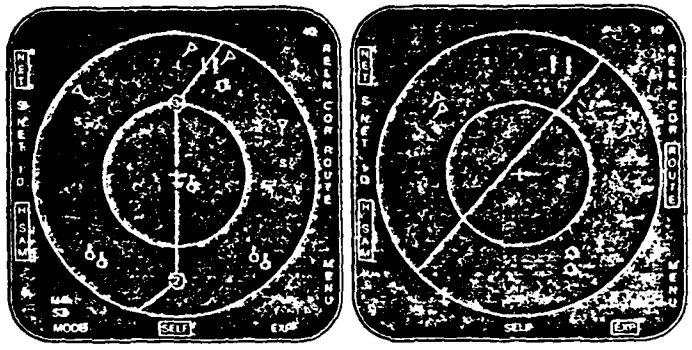
The hybrid system provides information regarding:

- position and track of friendly and hostile aircraft for air defense operations.
- position and track of hostile ground forces.
- fire requests.
- logistic support requests.
- electronic warfare direction finding.
- intelligence.



The PLRS JTIDS hybrid display can use tactical map displays to indicate ground force locations.

Nets can also be established with Air Force aircraft flying in support of ground operations. Division and corps vehicle convoy operations can be coordinated with ground forces for maximum effectiveness and identification for air defense.



Status and threat information from all airborne and ground sources is shared by all friendly forces permitting effective battlefield visibility and coordination in real time. The expanded display function allows the pilot to take a close look at threats far ahead in his planned mission.

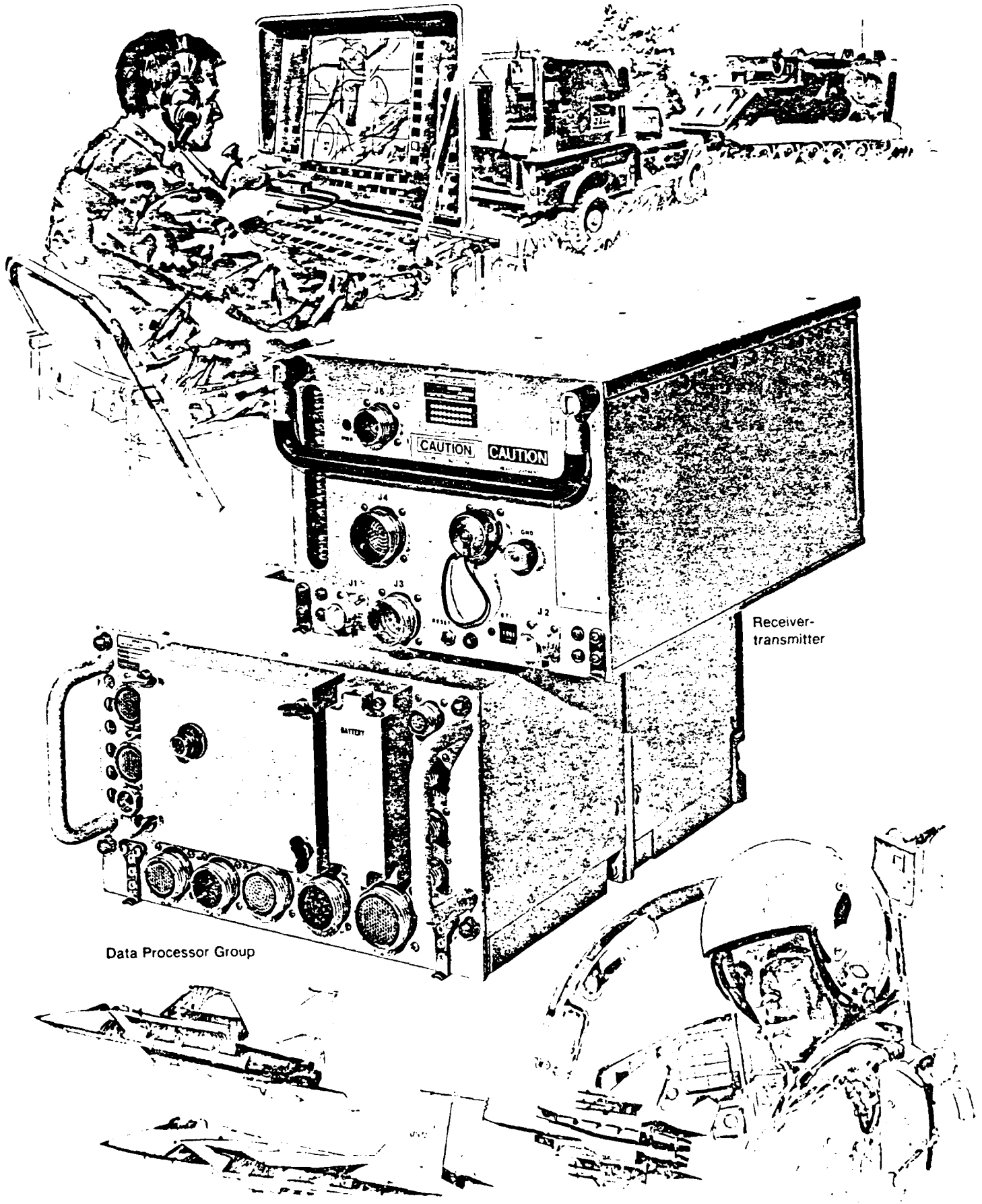
Compact JTIDS Class 2 Terminal

The Class 2 terminal is composed of a receiver-transmitter unit developed by Collins Government Avionics Division of Rockwell International and data processor group developed by Singer-Kearfott Division. JTIDS signal transmission and reception and Tactical Air Navigation (TACAN) signal processing is contained in the receiver-transmitter. Eight separate JTIDS receivers are contained in the airborne unit to acquire the JTIDS signal from any direction. Once the signal is acquired, four receivers maintain operations on the JTIDS Networks.

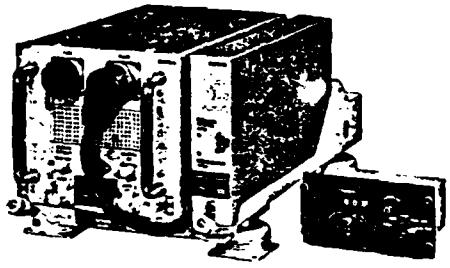
The data processor group provides receive signal detection, message processing, transmit message encoding and JTIDS network interface computations.

Contained within the data processor group is a MIL-STD-1553 data bus interface to the host aircraft's navigation, flight control, weapons, control, communications, radar and aircraft sensors. Interface to the pilot's control and display unit is also provided through the digital data processor group.

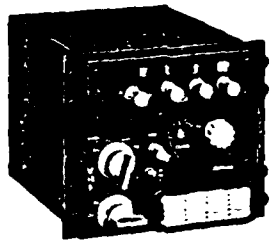
The terminal can be mounted in a variety of positions in the aircraft and, for ground applications, is housed in an immersion-proof case.


CAUTION
CAUTION
Receiver-
transmitter
Data Processor Group

Avionics Experience and Technology

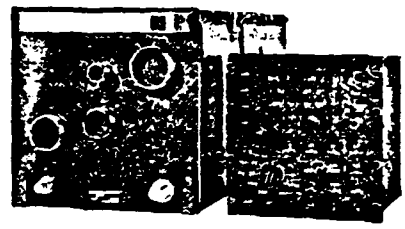


Collins Government Avionics Division's design-to-cost and equipment reliability capabilities enabled the division to win the contract for the U.S. Air Force standard TACAN, the AN/ARN-118(V), in 1975. The Collins AN/ARN-118(V) is the culmination of over 23 years of TACAN experience and 28 years of DME experience. The AN/ARN-118(V) is in use by over 35 different countries and is exhibiting a Mean-Time-Between-Failure rate (MTBF) in excess of 2,000 hours.



Collins AN/ARC-186 VHF Transceiver is also the standard for the U.S. Air Force and Army. Low acquisition costs, high reliability, fast repair times and use of existing common support equipment have more than doubled the U.S. Air Force's originally projected life cycle savings with the AN/ARC-186.

In recent U.S. Air Force reliability tests, the transceiver exhibited over 9,000 hours MTBF. The AN/ARC-186 has demonstrated operation in the VHF frequency hopping mode and has excellent growth potential for this mode due to its plug-in modular construction.



The Division is also involved in full scale development of user equipment for the NAVSTAR Global Positioning System (GPS). Collins user systems for the GPS will enable users on land, sea or air to passively determine their position within 16 meters in three dimensions, their velocity to one tenth of a meter per second and the correct time to within one nanosecond. The Collins user equipment is designed to have a high degree of common parts and modules to help make the system affordable and reduce maintenance expense.

The technological capabilities of Rockwell International will also contribute to Collins Government Avionics Division's JTIDS program. The Rockwell Microelectronic Research and Development Center provides a source of up-to-date electronics technology for the division. Notable achievements of this center include Very Large Scale Integrated Circuits (VLSI) and Galium-Arsenide devices.

The experience and background of the Rockwell team includes 50 years of designing and producing RF systems and two decades of tactical data link experience. This experience of a world leader in tactical communications will benefit the design and production of affordable, highly reliable JTIDS Class 2 terminals.

Collins JTIDS-TDMA Class 2 Terminal Specifications

Electrical

TDMA FREQUENCY COVERAGE:
969-1206 MHz.

TACAN FREQUENCY COVERAGE:
962-1213 MHz.

TDMA CHANNEL SPACING:
3 MHz.

TACAN CHANNEL SPACING:
1 MHz.

TDMA TRANSMITTER POWER:
200 watts.

TACAN TRANSMITTER POWER:
500 watts.

Environmental

AIRBORNE COOLING:
Aircraft supplied -54 to +49 °C @ [illegible] lb/minute kW minimum flow [illegible].

GROUND COOLING:
Self-contained blower.

Physical Characteristics

SIZE:
R/T — 10.125" W, 7.625" H, 15.562" L (25.72 cm W, 19.37 cm H, 39.53 cm L).
Data Processor Group — 12.656" W, 7.625" H, 15.562" L (32.15 cm W, 19.37 cm H, 39.53 cm L).

WEIGHT:
R/T — 51 lb (23 kg).
Data Processor Group — 74 lb (34 kg).

POWER REQUIREMENTS:
120/208 V ac, 50/60 or 400 Hz; or 250 V dc, 1,480 W.

Specifications subject to change without notice

For more information see our representative, or contact
Collins Government Avionics Division,
Rockwell International,
Cedar Rapids, Iowa 52498

Rockwell International

...where science gets down to business

DEPARTMENT OF THE ARMY
HEADQUARTERS XVIII AIRBORNE CORPS AND FORT BRAGG
FORT BRAGG, NORTH CAROLINA 28307-5000

REPLY TO
ATTENTION OF:

AFZA-CE

13 June 1985

SUBJECT: Tactical Data Transceiver Requirement

18 June
C/S -
Please task
out. Seems like
we have proved it
several times
already.
JS

Commander
U.S. Army Forces Command
Fort McPherson, Georgia 30330-6000

1. XVIII Airborne Corps has a critical requirement for a tactical data transceiver capability to provide interface with the CONUS wholesale supply system during contingency operations and OCONUS exercises. For 4 years the Corps had on loan from the USMC data terminals (AN/TYC-5A) that satisfied our requirements. The TYC-5A was used on all CONUS/OCONUS exercises to include URGENT FURY. The USMC ordered the return of the TYC-5A's in 1984. The Corps has been without this urgently required magnetic tape/data capability for over a year.

2. Supply transactions are processed at the GS level by the Corps Materiel Management Center in daily cycles on tactical ADP equipment (IBM 370/138). The resulting product is a magnetic tape which must be delivered or transceived to the Defense Automatic Addressing System (DAAS) and the CONUS logistics base. When XVIII Airborne Corps deploys as an independent corps, it has no tactical transceiving capability which will allow the Corps Signal Brigade to transceive large volumes of data.

3. Informal coordination with the materiel and combat development communities indicates that a combined data transceiver and remote message distribution system is the most desirable technical course of action. Both requirements can be resolved within existing state-of-the-art technology and within one shelter configuration.

4. Our studies indicate that we need data terminals which can transmit up to 65,000 supply transactions per day in magnetic tape format. These terminals should be sized and configured to fit the rapid deployability needs of this light corps. Details on both the data transceiver and remote message distribution system will be provided to your staff under separate cover. Request your assistance to obtain this capability as quickly as possible to alleviate the mission-capability shortfall we cur[illegible] in XVIII Airborne Corps; a shortfall that directly effects [illegible] survivability in combat.

JAMES J. LINDSAY
[illegible], USA
Commanding

URGENT LETTER REQUIREMENT (LR)
FOR THE
REMOTE MESSAGE DISTRIBUTION SYSTEM (INTERIM)

1. Title of the Item: Remote Message Distribution System.

2. Statement of the Need: An urgent requirement exists for an interim, secure, automated message processing and distribution system remoted to subscriber locations and terminated by "user friendly" terminals which require less than 2 hours of operator training.

3. Justification:

a. The lethality and fluid nature of the modern battlefield requires an air transportable and highly mobile communications capability which transceives large volumes of data and record traffic automatically between subscriber terminals through a corps area "common user" communications network that is interconnected with AUTODIN. Perishable intelligence information, operational data, and weather data are dynamic and require either updating or acquisition by adjacent staff elements or widely separated headquarters. None can tolerate the long delays incurred by current "over-the-counter" comcenter technology.

b. Operational Deficiency: The record traffic telecommunications capability of the Contingency Corps Signal Brigade has severe constraints and does not satisfy the dynamic requirements of the user in a tactical situation. Presently, the equipment required to provide essential service at each corps Command Signal Center is bulky and difficult to deploy into an objective area. Consequently, the equipment is not transported during the early stages of an operation resulting in the loss of an extremely vital capability to the commander during a very critical period. The ground commander must have access into the world-wide telecommunications network in order to ensure the flow of essential information between the objective area and all echelons of command up to the National Command Authority.

c. Operational Deficiency: Manual message processing procedures are time-consuming and not compatible with widely dispersed staff/operational elements nor the message processing and message accountability capability of the TRI-TAC, AN/TYC-39, automatic Message Switch. In practice, the use of brigade personnel operating AN/UGC-74 Communications Terminals within the Corps Tactical Operation Center (CTOC) has not significantly decreased record traffic-handling time delays. Rather, this practice has put an added strain on manpower and equipment resources of the brigade.

d. Once it is introduced into an area of operation (AO) and in keeping with the Dispersed Command Post (DCP) concept, the AN/TYC-39 must be located at increasing distances from staff/operating elements to enhance its survivability. It has the capability to accept, process, store, deliver,

Encl 2

and account for message traffic originating from remote terminal locations. What is required is for the customer, a clerk who is unfamiliar with formal communications procedures, to input required data through a keyboard in response to promptings by terminal computer software. Even before a wire/radio transmission path is installed by the Corps Signal Brigade, message traffic in ACP/JANAP/JINTACCS format can be stored in queue awaiting release into the world-wide common user communications network. After the communications system is activated, the message could be released into the network directly or through the local AN/TYC-39.

e. The modern battlefield, characterized by rapid displacements and changing situations, will decrease the use of Signal Corps personnel operating remote terminals at subscriber locations. The Signal Corps must devote more of its personnel resources to communications transmission (radio/cable) system installation, operation, and maintenance and become significantly less involved in message handling. However, the need for record traffic will persist. The AN/TYC-39 network has improved the time of transmission of messages from switch to switch or headquarters to headquarters, but writer to reader times have not significantly improved. The excessive handling time of record traffic is still a function of manual message centers at all command signal centers. Logging, reproducing, and delivering record traffic at each signal center incurs unnecessary and unacceptable delays in passing traffic from writer to reader in a responsive manner.

f. The Automatic Staff Message Processing Central (ASMPC), AN/TYC-16, was an interim mobile record traffic-handling system. Six staff remote terminals were provided for staff elements. In November 1982 two systems were delivered to 7th Signal Brigade, USAREUR, for field evaluation. From January to March 1983, four additional systems were delivered to V and VII Corps, FRG. A follow-on development by the Martin Marietta Corporation, Denver, Colorado, is the Standard Tactical Operations Facility (STOF). The STOF I was industry's response to a LR, approved by HQ TRADOC on 19 March 1980 (CARDS Ref No. 0811R) for an Interim Automated Staff Message Processing System. Its advantage over the TYC-16 is its size (one S-280 shelter vice two S-280 shelters mounted on an M-35, 2½ ton truck) and capabilities to service 14 local/distant remote subscriber terminals. An S-250 shelter configuration has been designed for the STOF II and is the preferred size for the Corps.

g. The Contingency Corps has an absolute requirement for downsized equipment. Currently, at each Corps Command Signal Center, it requires one AN/TYC-39 with its required PLL and maintenance shelters all mounted on either a 2½ ton or 5 ton truck, one AN/TSC-58 and one AN/GSQ-80 both mounted on 2½ ton trucks, and, for magnetic tape transmission, one AN/TYC-5A pulled by a 5 ton truck and mounted on a mobilizer to provide the required telecommunications center capability. This whole array of vehicles/equipment could be replaced by a system like the STOF II which consists of one S-250 shelter mounted assemblage and two support vehicles. At enclosure 1 is a graphic representation of the signal assemblages actually deployed to support Operation Urgent Fury in Grenada. This equipment was not deployed until 6 days into the operation, and its delay in entering the area severely

restricted the availability of critical information to the ground commander. This whole array of equipment could have been replaced by one system like the STOF II. This downsized record message traffic system would save a considerable number of aircraft sorties, ensure the early availability of this essential capability in the objective area, and provide a significantly reduced writer to reader transmission time. All worthy and achievable objectives.

4. Basis of Issue:

1 - XVIII Corps Main *
1 - Corps Forward *
1 - Corps Support Command (COSCOM) *
1 - 525th MI Brigade
*35th Signal Brigade operated

5. Principal Characteristics:

a. The remote message distribution system must be secure and include the following characteritics.

(1) Consist of commercial off-the-shelf components adapted for military use.

(2) Be compatible with the TRI-TAC architecture (i.e. AN/TYC-39, Automatic Message Switch) and provide a bridge to it from the current family of record traffic equipment.

(3) Be capable of accessing/switching not less than 13 common-user communications trunks either independent of the TRI-TAC network once it is established. It must terminate the following type circuits.

(a) Mode I.

(b) Mode II.

(c) Mode V.

(4) It is preferred that the Communications Central not exceed the size or weight capacities of a standard S-250 shelter and 1½ ton cargo trucks.

(5) Be designed to minimize operation and maintenance training requirements.

(6) Be capable of sustained 24 hour operation when powered by a 115/230 volt AC, 50/60 Hertz generator presently in the military inventory.

(7) Be TEMPEST certified at the shelter level in accordance with NACSEM 5100.

(8) Be designed and operated to meet the accreditation requirements of AR 380-380, Automated Systems Security.

(9) It is desirable that the Communications Central be capable of processing R and Y community traffic certified up to the level of SECRET and recognize/process the following message types.

(a) ACP-127. Plain dress, abbreviated plain dress, and NATO supplement 3.

(b) JANAP-128. Plain dress and abbreviated plain dress.

(c) JINTACCS message standards.

(10) The Communications Central will contain a modular, multimedia, send and receive (duplex) capability for narrative communications and consist of a keyboard, visual display, and printer.

(11) Provide an automatic journal for originated and terminated messages and recall within 60 seconds any message originated or terminated by the Communications Central and remote subscriber terminals during the previous 5 days. This capability would negate customer need for message duplication by copy machine.

(12) The Communications Central must be capable of switching/relaying messages originated by/destined to not less than 14 remote subscriber terminals.

(13) Remote subscriber terminals must consist of a keyboard, printer, and display, and incorporate a prompting capability that presents a fill-in-the-blanks menu (ACP/JANAP/JINTACCS) format.

(14) Operator training for non-communications personnel at the subscriber terminal should not exceed 2 hours.

b. Reliability, Availability, and Maintainability (RAM) Characteristics: Because the Remote Message Distribution System requirement can be satisfied with commercially obtainable equipment, the characteristics of the selected system will be consistent with the commercial performance of similar systems.

6. Testing Required: Limited testing will be required. Government acceptance testing will be conducted at the contractor's facility. Test results will be analyzed and approved by the joint material developer, combat developer, and user Test Integration Working Group (TIWG).

7. Logistical Support Implications: Supply and maintenance support of hardware and software will be provided in the same manner as for the TRI-TAC. AN/TYC-39, Automatic Message Switch. The MOS 36L (Electronic Switching Systems Repairer) will perform all repairs beyond the capability or scope of operator maintenance. Because of the interim nature of this material acquisition, a contractor maintenance/support representative with support/test equipment and spares will be available at Corps. Corps will program, budget, and contract for contractor support after the first year of fielding.

8. Training Assessment:

a. Operator training for the Communications Central will be performed by the contractor.

b. Subscriber terminal training will be facilitated by commercial manuals that are prepared in a Skill Performance Aid-type format.

9. Manpower/Force Structure Assessment:

a. Communications Central: The centrals will be operated by current signal battalion message center section personnel. It is anticipated that a 24-hour operation would require a minimum of one E-7 section chief (72E40), three E-5 shift supervisors (72E20), six E-4 telecommunication center specialists (72E10), and one cryptomaterials clerk (72E10). MTOE changes would be based on experience gained after fielding.

b. Subscriber Terminal: No change is anticipated. The present staff clerks will operate these terminals instead of utilizing typewriters.

c. Support Personnel: Because current MTOE's have been changed with the fielding of the TRI-TAC, AN/TYC-39, Automatic Message Switch, there should be no increased requirement for COMSEC, environmental control, or power generation personnel.

10 Other Services or Allied Nation Interest:

a. JCS Memo MJCS-173-84, 19 Sep 84, subj: Joint Acquisition of the Modular Tactical Telecommunications Center.

b. DA, Office of the Assistant Cheif of Staff for Information Management, Letter, DAIM-ADC-D, 18 Oct 84, subj: SAB (CARDS Reference No. 0800).

11. Life Cycle Cost Assessment: TBD.

ANNEX D

A C^3I HARDWARE REQUIREMENT: REMOTE MESSAGE
Distribution System (Interim)

Attached as enclosures are the following:

Enclosure #1. A letter from Commander, XVIII Airborne Corps, Fort Bragg, NC to Commanding General US Army Forces Command (Note: hand-written note in margin by FORSCOM Commander, General Sennewald) outlining a critical requirement for a tactical data transceiver capability to transmit large volumes of combat service support message traffic during contingency corps operations. As a lesson-learned from Operation URGENT FURY (Grenada) and in previous Joint Readiness Exercises (JRX) GALLANT KNIGHT, GALLANT EAGLE, BOLD EAGLE, and others, responsive C^3I support demanded that the Signal Corps focus on 'user-owned" and operated message terminal equipment. And, that these terminals be "user friendly" in that they require no more than two-hours of self-paced, computer-based instruction for noncommunications personnel. The letter also addresses the need for a remote message distribution system capability. Such a capability exists within V and VII Corps in Europe. Despite the XVIII Airborne Corps' previous request (i.e., Letter, AFZA-CE, Subject: Limited Procurement Urgent Letter Requirement (LR) for Interim Automated Staff Message Processing Central, dated, 23 December 1982), for battlefield automation support, none was available at the time of the URGENT FURY deployment.

Enclosure #2: On 27 September 1985, US FORSCOM forwarded the attached Letter Requirement (LR) to HQ TRADOC (ATTN: ATCD-CT)

recommending "the expeditious acquisition of four (4) Standard Tactical Operations Facilities (STOF), modified to accommodate [a] magnetic tape data transceiver capability" to meet both the transceiver and remote message distribution requirements. This later capability is in recognition of the trend to down=size the US Army Signal Corps (i.e., approximately by 5,000 personnel positions). also by remoting user subscribers, command post survivability is enhanced along with speed of customer service in record traffic message handling (i.e., writer to reader) time.

DEPARTMENT OF THE ARMY
HEADQUARTERS XVIII AIRBORNE CORPS AND FORT BRAGG
FORT BRAGG, NORTH CAROLINA 28107-5000

REPLY TO
ATTENTION OF:

AFZA-CE

13 June 1985

SUBJECT: Tactical Data Transceiver Requirement

Commander
U.S. Army Forces Command
Fort McPherson, Georgia 30330-6000

1. XVIII Airborne Corps has a critical requirement for a tactical data transceiver capability to provide interface with the CONUS wholesale supply system during contingency operations and OCONUS exercises. For 4 years the Corps had on loan from the USMC data terminals (AN/TYC-5A) that satisfied our requirements. The TYC-5A was used on all CONUS/OCONUS exercises to include URGENT FURY. The USMC ordered the return of the TYC-5A's in 1984. The Corps has been without this urgently required magnetic tape/data capability for over a year.

2. Supply transactions are processed at the GS level by the Corps Materiel Management Center in daily cycles on tactical ADP equipment (IBM 370/138). The resulting product is a magnetic tape which must be delivered or transceived to the Defense Automatic Addressing System (DAAS) and the CONUS logistics base. When XVIII Airborne Corps deploys as an independent corps, it has no tactical transceiving capability which will allow the Corps Signal Brigade to transceive large volumes of data.

3. Informal coordination with the materiel and combat development communities indicates that a combined data transceiver and remote message distribution system is the most desirable technical course of action. Both requirements can be resolved within existing state-of-the-art technology and within one shelter configuration.

4. Our studies indicate that we need data terminals which can transmit up to 65,000 supply transactions per day in magnetic tape format. These terminals should be sized and configured to fit the rapid deployability needs of this light corps. Details on both the data transceiver and remote message distribution system will be provided to your staff under separate cover. Request your assistance to obtain this capability as quickly as possible to alleviate the mission-capability shortfall we cu[illegible] in XVIII Airborne Corps; a shortfall that directly effects o[illegible]surv[illegible] in combat.

JAMES J. LINDSAY
Lieutenant General, USA
Commanding

URGENT LETTER REQUIREMENT (LR)
FOR THE
REMOTE MESSAGE DISTRIBUTION SYSTEM (INTERIM)

1. Title of the Item: Remote Message Distribution System.

2. Statement of the Need: An urgent requirement exists for an interim, secure, automated message processing and distribution system remoted to subscriber locations and terminated by "user friendly" terminals which require less than 2 hours of operator training.

3. Justification:

a. The lethality and fluid nature of the modern battlefield requires an air transportable and highly mobile communications capability which transceives large volumes of data and record traffic automatically between subscriber terminals through a corps area "common user" communications network that is interconnected with AUTODIN. Perishable intelligence information, operational data, and weather data are dynamic and require either updating or acquisition by adjacent staff elements or widely separated headquarters. None can tolerate the long delays incurred by current "over-the-counter" comcenter technology.

b. Operational Deficiency: The record traffic telecommunications capability of the Contingency Corps Signal Brigade has severe constraints and does not satisfy the dynamic requirements of the user in a tactical situation. Presently, the equipment required to provide essential service at each corps Command Signal Center is bulky and difficult to deploy into an objective area. Consequently, the equipment is not transported during the early stages of an operation resulting in the loss of an extremely vital capability to the commander during a very critical period. The ground commander must have access into the world-wide telecommunications network in order to ensure the flow of essential information between the objective area and all echelons of command up to the National Command Authority.

c. Operational Deficiency: Manual message processing procedures are time-consuming and not compatible with widely dispersed staff/operational elements nor the message processing and message accountability capability of the TRI-TAC, AN/TYC-39, automatic Message Switch. In practice, the use of brigade personnel operating AN/UGC-74 Communications Terminals within the Corps Tactical Operation Center (CTOC) has not significantly decreased record traffic-handling time delays. Rather, this practice has put an added strain on manpower and equipment resources of the brigade.

d. Once it is introduced into an area of operation (AO) and in keeping with the Dispersed Command Post (DCP) concept, the AN/TYC-39 must be located at increasing distances from staff/operating elements to enhance its survivability. It has the capability to accept, process, store, deliver,

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and account for message traffic originating from remote terminal locations. What is required is for the customer, a clerk who is unfamiliar with formal communications procedures, to input required data through a keyboard in response to promptings by terminal computer software. Even before a wire/radio transmission path is installed by the Corps Signal Brigade, message traffic in ACP/JANAP/JINTACCS format can be stored in queue awaiting release into the world-wide common user communications network. After the communications system is activated, the message could be released into the network directly or through the local AN/TYC-39.

e. The modern battlefield, characterized by rapid displacements and changing situations, will decrease the use of Signal Corps personnel operating remote terminals at subscriber locations. The Signal Corps must devote more of its personnel resources to communications transmission (radio/cable) system installation, operation, and maintenance and become significantly less involved in message handling. However, the need for record traffic will persist. The AN/TYC-39 network has improved the time of transmission of messages from switch to switch or headquarters to headquarters, but writer to reader times have not significantly improved. The excessive handling time of record traffic is still a function of manual message centers at all command signal centers. Logging, reproducing, and delivering record traffic at each signal center incurs unnecessary and unacceptable delays in passing traffic from writer to reader in a responsive manner.

f. The Automatic Staff Message Processing Central (ASMPC), AN/TYC-16, was an interim mobile record traffic-handling system. Six staff remote terminals were provided for staff elements. In November 1982 two systems were delivered to 7th Signal Brigade, USAREUR, for field evaluation. From January to March 1983, four additional systems were delivered to V and VII Corps, FRG. A follow-on development by the Martin Marietta Corporation, Denver, Colorado, is the Standard Tactical Operations Facility (STOF). The STOF I was industry's response to a LR, approved by HQ TRADOC on 19 March 1980 (CARDS Ref No. 0811R) for an Interim Automated Staff Message Processing System. Its advantage over the TYC-16 is its size (one S-280 shelter vice two S-280 shelters mounted on an M-35, 2½ ton truck) and capabilities to service 14 local/distant remote subscriber terminals. An S-250 shelter configuration has been designed for the STOF II and is the preferred size for the Corps.

g. The Contingency Corps has an absolute requirement for downsized equipment. Currently, at each Corps Command Signal Center, it requires one AN/TYC-39 with its required PLL and maintenance shelters all mounted on either a 2½ ton or 5 ton truck, one AN/TSC-58 and one AN/GSQ-80 both mounted on 2½ ton trucks, and, for magnetic tape transmission, one AN/TYC-5A pulled by a 5 ton truck and mounted on a mobilizer to provide the required telecommunications center capability. This whole array of vehicles/equipment could be replaced by a system like the STOF II which consists of one S-250 shelter mounted assemblage and two support vehicles. At enclosure 1 is a graphic representation of the signal assemblages actually deployed to support Operation Urgent Fury in Grenada. This equipment was not deployed until 6 days into the operation, and its delay in entering the area severely

restricted the availability of critical information to the ground commander. This whole array of equipment could have been replaced by one system like the STOF II. This downsized record message traffic system would save a considerable number of aircraft sorties, ensure the early availability of this essential capability in the objective area, and provide a significantly reduced writer to reader transmission time. All worthy and achievable objectives.

4. Basis of Issue:

1 - XVIII Corps Main *
1 - Corps Forward *
1 - Corps Support Command (COSCOM) *
1 - 525th MI Brigade
*35th Signal Brigade operated

5. Principal Characteristics:

a. The remote message distribution system must be secure and include the following characteritics.

(1) Consist of commercial off-the-shelf components adapted for military use.

(2) Be compatible with the TRI-TAC architecture (i.e. AN/TYC-39, Automatic Message Switch) and provide a bridge to it from the current family of record traffic equipment.

(3) Be capable of accessing/switching not less than 13 common-user communications trunks either independent of the TRI-TAC network once it is established. It must terminate the following type circuits.

(a) Mode I.

(b) Mode II.

(c) Mode V.

(4) It is preferred that the Communications Central not exceed the size or weight capacities of a standard S-250 shelter and 1¼ ton cargo trucks.

(5) Be designed to minimize operation and maintenance training requirements.

(6) Be capable of sustained 24 hour operation when powered by a 115/230 volt AC, 50/60 Hertz generator presently in the military inventory.

(7) Be TEMPEST certified at the shelter level in accordance with NACSEM 5100.

(8) Be designed and operated to meet the accreditation requirements of AR 380-380, Automated Systems Security.

(9) It is desirable that the Communications Central be capable of processing R and Y community traffic certified up to the level of SECRET and recognize/process the following message types.

(a) ACP-127. Plain dress, abbreviated plain dress, and NATO supplement 3.

(b) JANAP-128. Plain dress and abbreviated plain dress.

(c) JINTACCS message standards.

(10) The Communications Central will contain a modular, multimedia, send and receive (duplex) capability for narrative communications and consist of a keyboard, visual display, and printer.

(11) Provide an automatic journal for originated and terminated messages and recall within 60 seconds any message originated or terminated by the Communications Central and remote subscriber terminals during the previous 5 days. This capability would negate customer need for message duplication by copy machine.

(12) The Communications Central must be capable of switching/relaying messages originated by/destined to not less than 14 remote subscriber terminals.

(13) Remote subscriber terminals must consist of a keyboard, printer, and display, and incorporate a prompting capability that presents a fill-in-the-blanks menu (ACP/JANAP/JINTACCS) format.

(14) Operator training for non-communications personnel at the subscriber terminal should not exceed 2 hours.

b. Reliability, Availability, and Maintainability (RAM) Characteristics: Because the Remote Message Distribution System requirement can be satisfied with commercially obtainable equipment, the characteristics of the selected system will be consistent with the commercial performance of similar systems.

6. Testing Required: Limited testing will be required. Government acceptance testing will be conducted at the contractor's facility. Test results will be analyzed and approved by the joint material developer, combat developer, and user Test Integration Working Group (TIWG).

7. Logistical Support Implications: Supply and maintenance support of hardware and software will be provided in the same manner as for the TRI-TAC, AN/TYC-39, Automatic Message Switch. The MOS 36L (Electronic Switching Systems Repairer) will perform all repairs beyond the capability or scope of operator maintenance. Because of the interim nature of this material acquisition, a contractor maintenance/support representative with support/test equipment and spares will be available at Corps. Corps will program, budget, and contract for contractor support after the first year of fielding.

8. Training Assessment:

a. Operator training for the Communications Central will be performed by the contractor.

b. Subscriber terminal training will be facilitated by commercial manuals that are prepared in a Skill Performance Aid-type format.

9. Manpower/Force Structure Assessment:

a. Communications Central: The centrals will be operated by current signal battalion message center section personnel. It is anticipated that a 24-hour operation would require a minimum of one E-7 section chief (72E40), three E-5 shift supervisors (72E20), six E-4 telecommunication center specialists (72E10), and one cryptomaterials clerk (72E10). MTOE changes would be based on experience gained after fielding.

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11. Life Cycle Cost Assessment: TBD.

END

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